THE ILLUMINATING ENGINEER

LIGHT
LAMPS
FITTINGS
AND
ILLUMINATION

THE JOURNAL OF

GOOD LIGHTING

Official Organ of the Illuminating Engineering Society

FOUNDED IN LONDON 1908

Edited by
J. STEWART DOW

OIL
GAS
ELECTRICITY
ACETYLENE
PETROL-AIR
GAS
ETC.

Vol. XXIII | October, 1930 | Price NINEPENCE
Subscription 10/6 per annum, post free
For Foreign Countries, 15/- per annum.

Special Public Lighting Number

This number contains a full account of the Seventh Annual Conference of the Association of Public Lighting Engineers, which took place in Leicester during September 8th-12th. Other items include; a Shop and Display Lighting Campaign, Lighting Developments in Berlin—News from Abroad, etc.

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EDITORIAL AND PUBLISHING OFFICES:
32 VICTORIA STREET, LONDON, S.W. 1.
Tel. No.: Victoria 5215

Public Lighting

THE Conference of the Association of Public Lighting Engineers in Leicester during September 8th to 11th was generally considered to be a highly successful gathering. It is interesting to observe how a distinctive note is apt to be struck at each successive meeting. On this occasion the Presidential Address, by Mr. Thomas Wilkie, contained a strong plea for the well-equipped testing laboratory, and quite half the papers were concerned with laboratory experience. The President also emphasized the importance of the work to be done by the qualified public lighting engineer, who should be truly independent, and should not be associated directly either with the local gas or the local electrical undertakings.

During its short period of existence the Association has shown that both these demands are justified. The records of its successive Presidents have revealed how much can be done by the skilled public lighting engineer if he is given a reasonably free hand, and is allowed to concentrate his attention on this particular job. Annual reports of public lighting almost invariably demonstrate the important part played by the laboratory in preparing the way for improvements and in making possible economies. In any large city a well-equipped testing laboratory in competent hands is a thoroughly good investment.

We are equally in accord with the suggestion that the public lighting engineer should occupy a responsible and independent position "unhampered by the exigencies of either the gas or electricity undertakings." There are at the present time too few experts on lighting outside the service of supply undertakings and manufacturing firms. One valuable function of the Association should be the gradual assembly of a group of men whose outlook on lighting is at once informed and independent. Equally valuable is the opportunity which these conferences afford of enabling public authorities to testify to "the faith that is in them." It was heartening to hear the Lord Mayor of Leicester (an ex-chairman of the Lighting Committee) giving expression to the increasing recognition of the value of good public lighting, and dwelling with satisfaction on the advances that have recently been made in that city.

The papers gave rise to much animated discussion, and the series of tests organized by the Illumination Research Committee and the N.P.L., on September 9th, provided another topic of interest. The analysis of the views recorded on the degree of glare, visibility, etc., in the various installations should prove informative, and the thanks of members and delegates are due to Dr. Walsh, Mr. Stiles, and the others for preparing these experiments.

The Association has this year prepared an annual report surveying the work of the past session, and containing, as an appendix, a record of developments in lighting contributed by members for their respective areas. We are glad to see that this step, suggested at the annual meeting last year, has been carried into effect, and congratulate the Hon. Editor, Mr. E. J. Stewart, on the compilation of the report.

Another important step, proposed by Mr. Wilkie in his Presidential Address and approved at the business meeting, was the formation of four standing committees: (1) Parliamentary, (2) Tariffs, (3) Safety, and (4) Technical. Much valuable work should be done by these committees in studying such vexed questions as the lighting of arterial roads, and in collecting data illustrating the importance of good public lighting in the interests of safety.

It will be gathered that the conference afforded plenty of occupation for members and delegates. Meetings were well attended, and many members took part in the street tests, which lasted until the small hours of Wednesday morning. The actual work done at meetings or in committees, however, forms but a part of the "performance" of these annual conferences, which afford the one opportunity during the year for public lighting engineers to get together.

We would like to record one other pleasing event—the presentation made to Capt. W. J. Liberty on the occasion of his retirement from the office of Hon. Secretary. The presentation was made in the course of the annual dinner by Mr. S. B. Langlands, who recalled the part played by Capt. Liberty in founding the Association, and paid a tribute to his ungrudging services as Honorary Secretary during the subsequent seven years. We feel quite sure that all who are familiar with the progress of the Association since its foundation will join with pleasure in this recognition of Capt. Liberty's services.

We may conclude this note by wishing the Association continued prosperity until next year, when members reassemble in Edinburgh for an important session, to be held in conjunction with the International Illumination Commission.

The Elimination of Glare in Street Lighting

THE old problem of the relation between glare and visibility in street lighting was revived by the ingenious tests contrived for the benefit of visitors to the annual conference of the Association of Public Lighting Engineers in Leicester last month. The conclusions drawn from the series of experiments in Sheffield in 1928 were somewhat indefinite, but this was perhaps hardly surprising, considering the large number of factors entering into the tests and the variety of conditions examined. The procedure at Leicester was simpler, and in most cases it was easier to give a decisive reply. We shall be disappointed if the tabulation of this series of comparisons does not lead to some definite inferences.

Without in any way attempting to pre-judge the results of these experiments, we may perhaps be permitted to comment on one gradual change in outlook on street lighting during recent years—the increased importance assigned to glare. The tests at Sheffield did much to start this "swing over," though at that time the significance of glare was less generally accepted than is the case now. It has long been recognized that, with the present long distances between lighting units, street lighting involves a compromise. A high degree of uniformity involves high candle-power at angles slightly below the horizontal, and this in turn necessarily gives rise to glare. Until recently, designers generally were apt to attach most importance to uniformity of illumination, or shall we say provision of maximum mid-point illumination for a given expenditure? It was assumed that if lamps were sufficiently high (say 20 ft. or more) great brightness did not matter. At the present moment it is becoming recognized that in the sombre surroundings of the street glare and dazzle are fatal; and that, if only this defect can be remedied, very great uniformity is not so vital—provided the transition from high to low illuminations is gradual and there are no sudden contrasts in brightness. (It is this quality which laymen usually have in mind when they describe certain systems as "uniform.")

It is difficult to devise any test which estimates completely the effect of bright lights on the motorist and the pedestrian. In these days, when motion is rapid and decisions must be taken suddenly, judgment may be upset by a light seen "out of the tail of the eye." It is unsafe to assume that a bright source which does not fall within the direct range of vision is innocuous—that persons can be relied upon to gaze ahead without occasionally elevating their eyes. It is only when one can look out on a square or a street, without a single light source being visible (as used to happen occasionally during the war), that one realizes the degree of freedom and relief arising from complete elimination of glare.

If this is admitted, how comes it that street lamps are not invariably completely screened from view by means of reflectors with a deep angle of cut-off? One evident reason is again the unduly great distance between successive posts, which is still usual in our cities. With a complete cut-off there is danger that the beams from successive lamps may not overlap and an intermediate region may be left unlighted. Where closer spacing can be adopted this method has, in fact, been adopted with good results, and it seems to be becoming increasingly popular on the Continent.

There remains, however, the æsthetic objection to the "tunnel effect," i.e., the complete cut-off of all rays above the horizontal and the darkening of the faces of buildings—practically all the available light being concentrated on pavements and roadway. If owners of buildings could be relied upon to make good this omission by the adoption of floodlighting, luminous signs, and so forth, the concentration of public lighting on the roadway would not matter. But, as such suplementary lighting cannot be relied upon, it is expedient, in many streets, to allow a small proportion of light to pass outward and upwards. This, however, can be done to a quite sufficient extent by providing reflectors which still screen mantles or filaments completely, but are mildly translucent—if practicable, we would almost prefer a limit of 5 to 10 candles per square inch.

This mild degree of brightness could hardly give rise to glare, and would probably be sufficient to mitigate the somewhat depressing "tunnel effect." It would also furnish the motorist with adequate guidance as to the course of the roadway in all ordinary circumstances. For this purpose the brightness would still answer even in a light mist. It is true that sources of such mild luminosity would rapidly become invisible in a fog; but, after all, even dazzling lights would then be of little service, and it would seem inexpedient to design street lighting for these exceptional circumstances when by so doing we prejudice its utility for normal use.

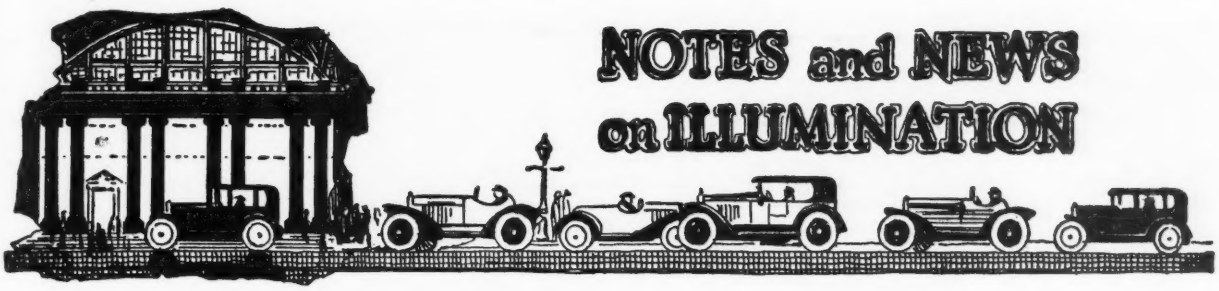
On the whole, therefore, we are disposed to think that the tendency in street lighting of the future will be towards more complete elimination of glare, probably not by complete screening of sources from view, but by the use of fittings of pleasing shape and mild luminosity, which, whilst directing the greater part of their light downwards, allow a small amount of diffused light to penetrate upwards and outwards.

Education for Commerce

IN his paper to the British Association on the above subejct, Sir Francis Goodenough deprecated the usual interpretation of the phrase "Business is business" as justifying a code of ethics below that adopted in sport or in daily intercourse. Business, he said, was not a warfare between buyer and seller, not a contest between men out to best one another, but a form of mutual service. Commerce was, first and last, a question of human relationships. Moreover character, ability, knowledge and skill must be employed scientifically. "The British Association could do no greater service to the nation than that of impressing upon the world of commerce and industry the truth that scientific methods are imperatively demanded alike in the fields of production, management and marketing."

In truth, commerce has not been recognized as a science at all. It has been regarded as something that "anyone can pick up," so that young men and women go into business without suitable education or training. Many employers who realize more or less vaguely that this is wrong assume that, owing to the infinite variety of businesses that exist, business cannot be reduced to a science and studied as such. In reality there is a science of business. The same principles apply to selling lemons as to selling locomotives, to selling meat as to selling motor cars.

It may well be urged that the sale of light, whether by the agency of gas, electricity, lamps or fittings, is a business to which the above principles apply in a special degree. There is no business which is more essentially scientific in the technical sense, and none which involves more careful consideration of human relationships.



The Illuminating Engineering Society

(Founded in London, 1909)

OPENING MEETING.

We are informed that the Opening Meeting of the next session will be held at the E.L.M.A. Lighting Service Bureau (15, Savoy Street, London, W.C.) at 6.30 p.m. on Wednesday, October 8th. This opening meeting will, as usual, be devoted to the Report of Progress and Exhibits illustrating recent developments in Illuminating Engineering. Any members of the Society who are prepared to make exhibits of interest are invited to communicate with the Hon. Secretary (Mr. J. S. Dow, 32, Victoria Street, London, S.W.1).

We understand that the next item on the programme, in November, will be a paper by Mr. J. A. Macintyre dealing with office lighting, and that other papers on the lighting of garages and repair shops, gas lighting and other subjects will follow, one evening, as usual, being devoted to miscellaneous problems in illuminating engineering.

New Forms of Road Surfaces

In discussions on street lighting, objection is very frequently taken to the shiny and yet dark surfaces of tarred roads. Both the dark texture and the polish are drawbacks from the standpoint of the lighting expert. It has been suggested that the concrete surfaces common in America are much better, being both light in colour and less liable to become shiny. Natural concrete, however, affords rather extreme conditions. The light surface is useful at night, but is apt to become distinctly glaring during the day when illuminated by full sunlight. Experiments are now being conducted in Brighton and Leyton with a buff-coloured variety of concrete. Already sections of roadway have been treated with this new material, which is considered promising.

Industrial Welfare

Many of our readers will doubtless be familiar with the enterprising monthly journal issued under the above title by the Industrial Welfare Society. The number before us contains a number of stimulating articles. There is an analysis of the causes underlying the world-wide industrial depression. Other contributions cover such varied topics as the prevention of accidents, the organization of winter games and the problem of noise prevention. An article by Mr. J. Stewart Dow sets out the main principles of industrial lighting, and reference is made to the bulletin (210) forming one of the "Encyclopædia of Hygiene, Pathology and Social Welfare" series issued by the League of Nations.

Automatic Traffic Signals in London

Sufficient time has now elapsed to enable the utility of the automatic light signals erected in Ludgate Circus to be judged. We believe that the authorities are satisfied that this has been a success—not only from the standpoint of drivers but also of pedestrians. In fact it has recently been proposed to multiply the signals so that they are visible to pedestrians from all directions. According to *The Times* it is now intended to introduce the system at various other busy centres. Cannon Street and Blackfriars Bridge have been mentioned as points requiring prompt treatment, and we understand that Oxford Street (a notoriously congested quarter) will probably be dealt with later.

Reduced Prices for Electric Lamps

A welcome reduction in the price of electric lamps has been announced by the E.L.M.A. manufacturers, and came into operation on September 1st. The price of Pearl lamps, in what may be termed the household sizes (25, 40 and 60 watts), is now below 2s., and the price of the Pearl 100-watt lamp (3s.) is very much below that ruling only a few years ago. Yet the present lamp is undoubtedly a far better product than that available in the past. Mr. C. W. Sully, director of the E.L.M.A., in a recent interview pointed out that the cost of the 60-watt lamp is to-day only about 1s. 3d. *below* its pre-war price, whereas the cost of living is nearly 2s. 3d. *above* the pre-war level. Moreover, during the period 1921-29 the average price per unit of electricity sold has diminished progressively from 5.75 to 3.05 pence. On the whole, therefore, the consumer has not done badly, and the cost of electric light makes a good showing as compared with many other commodities. The present step is doubtless due largely to concentration on the five main sizes for general use. We are not without hope that ultimately standardization may bring about yet further reductions, and that the progressive diminution in prices since pre-war days will continue.

Educational and Documentary Films

An instructive report on the above subject was recently presented to the British Association by a committee of which Sir Richard Gregory is chairman. The report contains a section prepared by Mr. J. S. Dow, outlining some conditions to be complied with by portable apparatus used in schools, etc., with a view to avoidance of eyestrain. With standard equipment a screen illumination of about 7 foot-candles seems feasible. Reference is made to the conclusions of the joint committee appointed in 1919 by the Illuminating Engineering Society at the request of the L.C.C. with a view to minimizing eyestrain. This committee proposed to limit the angle of elevation of the eye to the top edge of the picture to 35°. It is suggested that, with screens of the size customary in schoolrooms (i.e., $3\frac{1}{2}$ ft. to 4 ft. square), seats should not be nearer to the screen than 7 ft., and not further than about 50 ft.; also that the width of the space occupied by the audience should not exceed 20-25 ft.

A Jacopozzi Sign for London

We recently referred to the striking design of many luminous signs in Paris, which are due to the ingenuity of M. Fernand Jacopozzi. It is, therefore, interesting to observe that, according to *Signs*, London is shortly to benefit by his efforts. The new sign is to be installed outside the new Gamage store in Oxford Street, but it is probable that the complete equipment will not be in position until after the Christmas decorations have been removed. This incursion will be watched by lighting experts in this country with considerable interest.

Royal Sanitary Institute

ANNUAL CONGRESS, 1931.

The 42nd Congress and Health Exhibition of The Royal Sanitary Institute will, at the invitation of the Corporation, be held at Glasgow from July 4th to July 11th, 1931, under the presidency of Sir Henry Mechan, LL.D.

Illuminating Engineering Society in Germany

EIGHTEENTH ANNUAL MEETING.

The annual meeting of the Illuminating Engineering Society in Germany took place in Potsdam on September 26th. The business before the meeting included the consideration of the new recommendations on lighting which were summarized in our last issue. Three papers, read by Dr. Schröter, Dr. Sewig and Dr. Samson, dealt with applications of photo-electric cells as an aid to photometry, whilst Dr. Pirani discussed the photometry of luminous tubes.

Illuminating Engineering Society (U.S.A.)

TWENTY-FOURTH ANNUAL CONVENTION.

The programme of the twenty-fourth annual convention of the Illuminating Engineering Society (U.S.A.), which is being held in Richmond, Virginia, during October 7th–10th, covers a wide field. Approximately 40 papers and reports will be presented. As has been the custom during recent years, papers are grouped, special sessions being devoted to lighting practice, lighting service, education, exterior lighting, natural lighting, and ultra-violet light.

Original Types of Lighting Fittings

Unusual lighting fittings figured prominently at the recent fourth Exhibition of Decorative Art, held at Monza (Italy), which is discussed in *Illuminotecnica*. Many of these fittings are of the now familiar " architectural " type, embodying geometrical designs in translucent glass, but some of the designs shown are novel. One is struck by the prevalence of luminous tubes and cylinders, sometimes in the ordinary closed form, but occasionally as an open spiral—a form adapted to table lamps. One singular fitting illustrated might be likened to a bunch of luminous bananas! One notices also a tendency to use luminous dishes in cascade, producing a sort of pagoda effect, and to incorporate lighting devices in other decorative objects. Portable lamps having at the base a bowl of water containing some curious marine creatures are shown, and in one case the lighting unit surmounts what is apparently a miniature aquarium.

Neon Signs in Paris

As is generally known, neon tubes figure very largely in signs used in Paris, some of which show great originality. An effective example is illustrated in *Signs*—the display on the façade of the Olympia Cinema, on the Boulevard des Capucines. Here the name and the sun and its rays are traced in red, the adjacent circles and ornamental design in green and blue. It is remarked that although the Olympia has not a very large frontage the application of this neon tubing, which is worked in as an element in the architecture, has made it one of the most prominent buildings in Paris. The variety of colour now available from neon tubes has added considerably to their decorative possibilities. Perhaps the most effective devices of all are those in which incandescent lamps and neon tubes are combined. This form of sign is becoming very popular abroad.

Ice as an Element in Decorative Lighting

The winter of 1929–30 marked the twenty-fifth anniversary of the Winter Sports Club at Lake Placid, in the heart of the Adirondacks. A contribution by Mr. L. C. Porter and Mr. W. A. Steiger to the *General Electric Review* (U.S.A.) describes the efforts made to commemorate this event by suitable lighting effects. The fine trees surrounding the lake, covered with ice and snow, offered excellent objects for floodlighting. The colour effects produced were very striking. This, however, was nothing new, and it was decided to try the effect of incandescent lamps frozen into solid ice. It was by no means certain what would happen to the lamps in these circumstances, but preliminary experiments with artificial ice showed that the idea was quite practicable. The idea of mounting lamps in the heart of pyramids of broken ice appeared particularly promising. In the course of the initial experiments it was found that a beam of light could be projected through clear artificial ice with much less diffusion than would occur through a similar depth of water; the light was hardly visible where it passed through the clear ice, but was broken up into prismatic colours wherever it encountered snow ice, cracks or crystals. Luminous designs could readily be executed by merely tapping the surface of clear blocks of ice with a hammer. Piles of broken ice having slow-flashing coloured lamps embedded in them had a very striking, scintillating appearance. The best effect was obtained by leaving one lamp in every four burning steadily, thus causing the colour changes to take place more gradually and without a jerky effect. Piles of ice naturally tend to dwindle in midday sunshine. More ice can be added, but there is a tendency for wires and sockets to come gradually to the surface. If a pile is to operate for a considerable time it is therefore better that lamps and wiring should be supported. This was done by means of wooden framework resembling a Christmas-tree, around which a pyramid of broken ice was built up. Another device was the outlining of a large star by means of coloured lamps frozen in under the surface of the lake. This aroused much curiosity amongst skaters. Although some 2,250 watts was expended, the heat of the lamps did not affect the skating surface immediately above them.

The Measurement of Very Weak Luminosities

An interesting study of the above subject is contributed by M. J. Dufay and Mlle. R. Schwegler to the *Revue d'Optique* (June-July, 1930). Brightness varying from 10^{-6} to 5×10^{-10} candles per square cm. was studied, and a formula was derived relating the precision of measurement to the brightness of the object and its apparent diameter. The minimum brightness perceptible is a function of the diameter of the source; for 0.25 radian it is in the neighbourhood of 10^{-10} candles per square cm. It is not often that the illuminating engineer is concerned with such low orders of brightness, though in dealing with phosphorescent and fluorescent materials (such as the radio-paints used for coating figures on the dials of watches and instruments) special problems arise. Even in this case, however, measurements can be made with greater precision than might be imagined.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

Association of Public Lighting Engineers

Seventh Annual Meeting and Conference

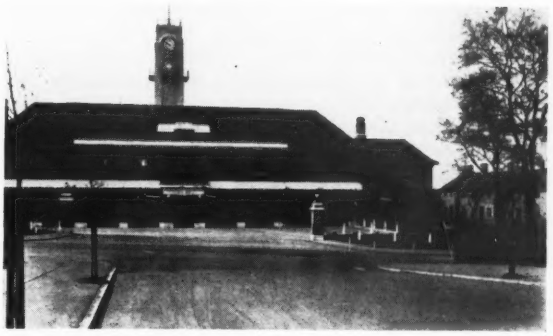
(*Held in Leicester, September 8th–11th*, 1930.)

THE Seventh Annual Meeting and Conference of the Association of Public Lighting Engineers, held in Leicester during September 8th-11th, 1930, proved to be a successful gathering. On the evening of the opening day (September 8th) visitors were received and entertained by the Lord Mayor, Councillor W. E. Hincks, O.B.E., J.P., who also extended to members and delegates an official welcome on the following morning when he presided over the opening of the conference in Lancaster Hall. The new President, Mr. Thomas Wilkie (Lighting Superintendent of Leicester) was the inducted, and the customary diploma was presented to the retiring President (Mr. S. B. Langlands).

The delivery of the Presidential Address was followed by a paper on "The Practical Use of a Test Room," by Messrs. W. I. Marshall and R. H. Redmill (members of the staff of the Leicester Lighting Department), after which members adjourned to luncheon in the Grand Hotel at the invitation of the Lord Mayor. In the afternoon there was first a highly entertaining display by the Leicester Fire Brigade, under the Chief Officer, Mr. H. Neal. Leicester is justly proud of its fire-fighting plant and its fire station, which is considered to be the best in England. It is interesting to observe how closely the fire brigade and the public lighting are linked in Leicester; it was noteworthy that the conferences took place in the Lancaster Hall, which forms a part of the fire brigade building.

After this display visitors assembled to hear the paper by Mr. C. I. Winstone and W. A. Bishop on Modern Street Lighting with Gas. The evening was devoted to a series of experiments arranged under the auspices of the Illumination Committee of the Department of Scientific and Industrial Research and the National Physical Laboratory. Comparisons between different installations taken in pairs were made, the nature of the fittings and especially the degree of glare varying, but the average illumination on the roadway being substantially the same throughout. Visitors were asked to record their judgment in regard to glare, visibility, attractive appearance, etc., on cards provided for the purpose. A considerable number of visitors took part in the tests, which lasted until the early morning.

Two papers were read on the second day summarizing "Laboratory Experience in Relation to Public Lighting." Dr. J. S. G. Thomas explained the practice of the South Metropolitan Gas Company, and Mr. G. H. Wilson (of the G.E.C. Research Laboratories) discussed methods as applied to electric lighting. Other papers presented included "The Lighting of Birmingham," by Mr. R. Mason and "Public Lighting as Viewed by the Motorist" (Mr. H. Sturgess-Wells, J.P.). A feature of the business meeting, which concluded the conference, was the presentation of the annual report, which surveyed the proceedings of the Association during the past year and included, as an appendix, notes on local developments in public lighting contributed by various members. It was announced that the meeting in 1931, which would be linked with the International Illumination Congress, would be held in Edinburgh. Mr. R. Beveridge. Inspector of Lighting in that City, was declared President-Elect. In the course of the proceedings it was mentioned that Mr. J. S. Dow had consented to become hon. secretary of the Association.



A view of Lancaster Hall, adjacent to the Central Fire Station, Leicester, where Conferences of the Association were held.

At the Annual Dinner, which was held at the Grand Hotel on the evening of September 10th, the toasts of "The City of Leicester," "The Association of Public Lighting Engineers," and "The Visitors," were proposed and drunk with enthusiasm. A pleasant item was the presentation made to Captain W. J. Liberty on the occasion of his retirement from the office of hon. secretary, which he had held since the formation of the Association seven years ago.

The arrangements for the final day included tours of visits to various local factories and a motor drive through Warwickshire to Royal Leamington Spa, where members and delegates were received by the Mayor of Leamington and entertained to tea by the Chairman and Directors of the Leamington Gas Company.

[On the following pages we give abstracts of the Presidential Address and of the various papers read. —Ed.]

PRESIDENTIAL ADDRESS

In his opening remarks, the President (Mr. Thos. Wilkie, Lighting Superintendent of Leicester) referred briefly to the general conditions of street lighting in Leicester, which, he said, were similar to most other cities in that its progress was in direct ratio to the money allocated. Within these limits they had progressed. If the next seven years' programme were completed according to schedule, Leicester would be one of the best-lit cities in Great Britain.

The gas and electrical undertakings were both owned by the Corporation. Generally speaking, all tram routes would be electrified, and all other roads, except those in new housing estates, would be lit by gas as at present. The decision to substitute electricity for gas in main roads, etc., was not taken without a good deal of thought. Two streets were selected of entirely similar conditions as to length, breadth, surroundings, etc., and the spacing and height of the units were as near as possible identical. One street was lit by gas and the other by electricity. As a result of these tests, the new programme was initiated. Approximately three miles of tram route would be re-lit by electricity every financial year and the gas plant released used in improving, first of all, secondary main roads and bus routes, and then side streets.

A feature in Leicester is the number of streets which are lit by gas on one side only. This is a relic of an older administration, which evidently considered that a gas main was unnecessary on both sides of the street, and that the expense of making a crossing for a public lamp was not justified. Many of these streets have already been altered. A number of ancient lanterns having opal or clear shoulders and without reflectors are also being changed at the rate of 300 per annum. These replacements commenced six years ago. The original 4,000 burners of a very inefficient type have long since disappeared.

During the past seven years the Department's accommodation has been altered and improved beyond recognition. Headquarters premises have been extended considerably and room found for new workshops, stores, test room and recreation room. In addition, there are five sub-offices in various parts of the city from which lamplighters radiate, and which are in charge of a foreman or timekeeper. Seven years ago the Department had really no administrative existence, being responsible only for lighting and cleaning gas lamps. To-day it has complete control of every gas and electric lamp, and the planning and carrying-out of all new works is undertaken by the Department's own staff.

Public lighting to-day, the President remarked, is receiving more attention than it has ever received in the past. Lighting is now regarded, more or less, as an essential service in the social order of things. The standard which was considered satisfactory for slow-moving traffic is now inadequate, but the necessity to alter the standard of expenditure is not yet generally recognized. Public lighting should be made the statutory duty of all local authorities. Local authorities should realize the advantages to be gained from putting public lighting in the hands of a qualified lighting engineer, holding an independent appointment, and preferably not actively interested in either gas or electrical undertakings. Some undertakings have not yet realized the immense advantage of retaining the public lighting load by offering special tariffs. Each of the above factors, in almost equal degrees, is retarding the provision of effective public lighting. It is the duty and privilege of this Association to endeavour to remedy this state of affairs.

The Association of Public Lighting Engineers was founded seven years ago, and was incorporated two years ago. During that time it has done much useful work. It is represented on the councils and committees of kindred associations. But the time is now ripe for the extension of this work. It is therefore proposed to set up a number of sub-committees, with wide terms of reference, to deal with the more important and outstanding problems, i.e., (1) Parliamentary, (2) tariffs, (3) safety, (4) technical.

(By the courtesy of "Electrical Industries.")

MR. THOMAS WILKIE

(President of the Association of Public Lighting Engineers, 1930-31).

The Parliamentary Sub-committee may be the most important. Its duty will be to build up a case for the inclusion in the Public Health Act of such legislation as will make the provision of public lighting a statutory duty and, as a natural corollary, the fixing of a definite maximum rate to be levied for this purpose. A further item which could usefully be dealt with is the possibility, and advisability, of capitalizing a portion of the Road Fund revenues for the lighting of arterial roads. It is almost incredible that in the twentieth century, with all its problems of traffic, speed and lamentable loss of life and limb, public lighting should still be an act of grace, and that the money required for this nowadays important service should be so sparingly granted and so ruthlessly pared. The sub-committee might decide what rate they consider reasonable. The President suggested a 9d. rate as a maximum. He did not think the average ratepayer would demur at the increase, which, in the case of Leicester, would mean 3.53d. per £. Assuming a more generous financial treatment, the B.E.S.A. Specification would doubtless be accepted as the standard of good public lighting. With regard to arterial roads, there was an unanswerable case, more especially where the road is through a populated district. In Leicester, for instance, a new arterial road was being made through the centre of the city, and had qualified for a Government grant. Nothing, however, would be obtained towards the cost of lighting—surely most illogical.

The Tariffs Committee would be the medium through which the views of the Association would be brought home to the gas and electrical undertakings. Much could be said on this matter of public-lighting tariffs, and it would be to the mutual advantage of undertakings and lighting committees if the question were thoroughly discussed.

The Safety Committee could probably work best in conjunction with the National Safety First Association. Local committees might be set up in every city represented in the Association, and exhaustive data collected relating to street accidents, their causes and their remedies. The police would, of course, be the most natural and useful allies. There should, in fact, be a searching enquiry into the cause of every accident, the blame, contributory or otherwise, apportioned, and the findings given the fullest publicity. This committee might also usefully go into the question of motor head-lights. It might be possible to prohibit their use in streets where a certain intensity of illumination was provided. Side-lights on stationary cars facing oncoming traffic were frequently the cause of accidents. Instead, small red lamps might be used while the car is stationary. These comparatively small lamps, when badly focussed, play a not inconsiderable part in street accidents. For instance, in Leicester last winter there were four fatal accidents within a very short period of time, and in two of the four cases the city coroner blamed insufficient public lighting. Having seen the depositions of the witnesses and visited the locations, the President said he was satisfied that the real cause in each case was simply a stationary car with side lamps.

In closing, the President emphasized to chairmen of lighting committees the desirability of appointing a fully qualified lighting engineer who would be unhampered by the exigencies of either the gas or electricity undertakings. The lighting engineer should be, under his committee, a free agent to adopt either system of lighting, and his duties should be so arranged that he could devote his whole energies towards efficiency.

The Practical Use of a Test Room

By W. I. MARSHALL and R. H. REDMILL

IN every public-lighting department there should be some sort of test room. The equipment need not be elaborate, and will vary with the size of area controlled, the generosity of the lighting committee, and the time which can be reasonably spent therein. The work carried on in the test room of a lighting department, as distinct from research laboratories, will generally be confined to problems directly affecting practical work. Theory usually precedes practice, and our tests are often limited to checking theory, corroborating makers' figures, and maintaining service results. In performing these duties alone, a test room justifies itself. It frequently happens, too, that these practical tests disclose defects in the construction of plant, and makers are generally pleased to receive constructive criticism of their products. In the course of wiring fittings for test, minor defects in construction are often revealed. Some of the lanterns submitted for test, whilst admirable for interior work, would present serious difficulties when actually in use on the streets. In short, a test room ensures that the most economical use is made of gas and electricity, while, at the same time, it tends to remove from the market defective, cheap, and inefficient fittings. In the test room also, there is scope for dealing with certain factors not directly under our control, such as gas pressures, composition of road surfaces, etc.

An essential piece of apparatus is, of course, the photometer, the actual type being governed by the space available. The type in use in our test room is illustrated in the original paper. This permits a standard surface to be rotated round the lamp tested, and the illumination thereon measured with a portable photometer.

The personal element is introduced in all types of visual photometers. This is particularly troublesome when there is colour difference between the test and standard lamps. No doubt in the future a suitable physical photometer, using photo-electric cells, may be devised. The balance in this case is effected not by vision but by galvanometer or electrometer.

Another useful piece of apparatus is the integrating sphere or cube, which permits rapid measurement of mean spherical candle-power of mantles and filaments. (This is also briefly described in the original paper.)

It is also necessary to have a lamp-testing board, complete with variable resistance, voltmeter and ammeters. Life tests on lamps, candle-power drop, current consumption, etc., are carried out on this board, and the results obtained are of great use. Each of the points on our lamp board is supplied by three independent circuits, viz.: (1) voltage direct from the mains; (2) voltage using resistance; (3) either of above, controlled by time-switch.

The latter is used in the case of a life, where every lamp under test is switched on and off once during each 24 hours, thereby approximating to actual service conditions. In regard to gas lighting, the ordinary candle-power tests are, of course, dealt with by the photometer. As all burners are fitted with fixed nipples, it is imperatime that each burner is systematically brought in for nipple readjustment and, of course, cleaning. For mantle testing an instrument is used which determines the tensile strength of the fabric after the collodion has been burned off. It provides a fairly rapid means of checking for comparison purposes. As a further check on makers' mantles, the standard shocking machine, operated by a fractional horse-power motor, may be applied.

The design of a lighting installation is, perhaps, the most important branch of the work carried out in the test room. The first point is to decide the minimum illumination required. The B.E.S.A. Specification divides road into eight classes, according to their relative importance, and a suggested *minimum illumination* is given for each class. Consideration must, however, also be given to *average illumination*, as it affords a much better indication of the relative merits of installations. With certain directional type fittings, while the illumination at the test-point may be of the required value, there are certain points at which the illumination is considerably below this figure.

Having determined the minimum illumination required, the mounting height is next considered. Here again the specification suggests a minimum mounting height for each class of street; but, besides the question of glare, the distribution of capital and cost must be considered. From considerations of glare, the higher units are mounted the better, but this occasions a corresponding decrease in illumination unless a higher luminous intensity per unit is allowed. A compromise between these factors is thus necessary, the height being chosen which will give the best distribution with the minimum amount of glare, and, at the same time, low capital and maintenance costs.

Once the mounting height has been determined, the distance between the units, measured along the centre of the road, is given by the equation:—

$$d = h \tan \theta + \sqrt{h^2 \tan^2 \theta - w^2}$$

w = width of road.
θ = angle of maximum candle-power.

The maximum candle-power required to produce the necessary test-point illumination is then given by:—

$$I_\theta = \tfrac{1}{2} \left(\frac{_m h^2}{\cos^3 \theta} \right)$$

E_m = test point illumination

A series of suitable fittings can now be chosen from makers' catalogues, and their polar distribution determined.

From the candle-power distribution curve, the theoretical performance of the installation can be determined. The horizontal illumination between two units is given by:—

$$E_u = \frac{2\, I_\theta \cos^3 \theta}{h_2}$$

$\theta = \tan^{-1} \frac{d}{h}$

The diversity factor (i.e., the ratio of maximum illumination to the minimum illumination) is given by:—

$$D.F. = \frac{I_o}{2\, I_\theta \cos^3 \theta}$$

Diversity factor has an important bearing on the question of visibility, and complete uniformity of illumination, apart from being impracticable, is not desir-

able. Providing the illumination falls evenly, a medium diversity factor is found to give better visibility than a very low one. This point was particularly well demonstrated at Sheffield, the following figures being abstracts from observational tests on visibility: —

Installation No.	Diversity Factor.	Estimated Visibility.
38	2 to 1	2.87
21	5 to 1	2.78
44	12 to 1	3.73
37	16 to 1	3.41

Another important factor to be considered in connection with visibility is the vertical component of illumination. This is given by: —

$$E_v = \frac{I\theta \cos^3 \theta \sin \theta}{h^2}$$

It is clear that an obejct, when seen by direct vision, is rendered visible by the vertical illumination falling on it. As the object moves further away from the source, it is rendered visible by contrast with the background illumination. Thus, for an object to appear visible at any point between two units, the ratio of vertical illumination to background illumination must always be more or less than unity, and the higher the ratio of one to the other the greater the contrast becomes, either direct or by silhouette. The critical value of this ratio will depend, to some extent, on the amount of glare from the installation.

Much attention has been paid to the subject of glare, but up to the present the data available is rather scanty, and further investigation is required before a definite solution is arrived at. The B.E.S.A. Specification has dealt with the problem, but even this cannot be accepted as final. For example, the glare curve of a certain scheme in Leicester was deduced by the method outlined in the specification, and the maximum value was found to fall within the limit of " 10 " set by the specification. Yet the scheme certainly exhibits serious signs of objectionable glare. In a subsequent scheme the mounting height was increased, with the result that the glare factor was reduced to 9. While the visibility did not seem in any way to be impaired, much less discomfort was felt when driving through in a car. It is the opinion of the writers that the maximum value of " 10 " is too high, and a maximum glare factor of 7 or 8 would seem more suitable.

At this juncture a brief description of a series of tests on visibility carried out in Leicester may be of interest. It was thought that the use of daylight lamps, which tend to show objects in their more natural colours, might give a better degree of visibility than the clear gasfilled lamp. A section of a certain scheme was fitted with 300-watt daylight lamps, the section comprising 12 units. The horizontal and vertical illuminations were measured. A contrast disc, similar to that used at Sheffield, was prepared. This disc was mounted on a wooden stand at a height of 5 ft. from the ground, and a camera, with the lens taken away, was placed 16 ft. from this stand. The observer looked through the camera shutter, and the length of exposure was varied until the position of the disc could be seen. The same procedure was followed with clear 300-watt lamps. Although illumination was found to be approximately 30 per cent. higher with clear lamps than with " daylight " lamps, the exposure in the latter case was almost invariably less. Although this method of appraisal cannot be claimed as a conclusive test of visibility, it is nevertheless a comparative test, both installations being tested under identical conditions. In addition to greater visibility, the glare from the installation of daylight lamps is proportionally reduced, and this, combined with the more natural colour of the illumination, affords less discomfort to the eyes of road users.

All previously mentioned calculations are, of course, purely theoretical, and do not take into consideration the reflection characteristics of road surfaces. It is often assumed that the brightness of the roadway varies in direct proportion to the illumination it receives, but this is far from the whole truth. The driver of a vehicle generally views the roadway a considerable distance away, with the result that his line of vision makes a very large angle with the normal to the road surface. In addition, some of light from a street lamp strikes the road surface at a very oblique angle. Consequently at that spot light is reflected regularly, and and the variation in surface brightness bears no comparison to the variation in illumination as calculated by the cosine law. The idea to be aimed at in street-lighting practice would appear to be a fairly uniform brightness of the road surface; this would necessitate a fairly high diversity of illumination (depending, of course, on the nature of the road considered). Assuming the reflection factor for a given road surface, at an angle of incidence θ, to be $\rho\theta$, the brightness of the roadway at any point is given by: —

$$B = \frac{\rho\theta \, I\theta \cos^3 \theta}{\frac{1}{4}h^3} \text{ Candles per sq. ft.}$$

The deductions arrived at from the foregoing laboratory tests are of great use as a preliminary predetermination, but a service test is essential when an installation is completed, in order that any modifications might be made. These modifications apply chiefly to focussing, as the height and spacing are, within limits, fixed. The service test is taken with some form of portable photometer, measurements of foot-candle illumination being taken at intervals of, say, 5 ft. between two adjacent units. Before taking the test, the voltage at the lamp terminals or, in the case of gas, the pressure, must be taken, and a correction factor used to compensate for any variation from the rated value. Readings are generally taken at ground level, care being taken to ensure that the test surface is perfectly level. Horizontal readings are usually taken, but where the illumination is of a low order normal readings are more conveniently taken, these then being converted into horizontal readings. The illumination at the test-point should also be measured, the test-point being defined at the point which is equidistant and furthest away from two adjacent units.

The efficient maintenance of an installation after erection is of great importance, and the period which should be allowed to elapse before the fitting is cleaned should be ascertained from actual test of the installation. The B.E.S.A. Specification states that the test-point illumination should not be allowed to fall below 50 per cent. of the original value, and this would appear to be a reasonable figure. Apparently dust collects on the inside of the glass, and leads to material absorption. A good case is therefore made out for non-ventilated fittings.

Once the installation has been proved satisfactory, a gauge should be made for the use of the maintenance staff, in order that correct adjustment is maintained after the cleaning of fittings, renewal of filaments, etc. With certain highly directional type fittings, the slightest variation in adjustment may cause a considerable drop in efficiency.

Within recent years considerable advances have been made in the manufacture of electric lamps. Lamp manufacturers have now definitely adopted the B.E.S.A. Specification, which specifies that the average life of an electric lamp shall be 1,000 hours, and, in addition, that the percentage drop in candle-power during this life shall not exceed 15 per cent. It is thus the duty of a public-lighting department, who are, of course, one of the largest consumers of electric lamps, to ensure that this standard is maintained, and periodic checks should be made on filaments supplied under contract. Lamps are taken at random from consignments as they come in, and are tested for: (1) initial candle-power; (2) length of life, with special regard to their efficiency.

Although apparently no recognized specification exists regarding the quality of gas mantles, it is nevertheless necessary to carry out periodic tests on samples, in order to ensure that the mantles supplied under contract are up to the standard specified in the original quotation. These tests comprise: (1) test of initial candle-power; (2) test of durability; (3) life test.

The first test is carried out with the integrating sphere, careful note being taken of the pressure and calorific value of the gas at the time of the test. For

the second test the most generally accepted practice is to use some form of shocking machine, with which the mantle, after the collodion has been burned off, is subjected to a number of "shocks" until it is shattered, the number of shocks being registered by an automatic counter. This is possibly the best method of testing mantles, as it approximates most closely to the actual destructive forces upon mantles on the street. Owing to the high durability of modern mantles, however, many thousands of shocks are required before the mantle is broken, and much time and energy are expended on each sample. A measurement of tensile strength is much quicker and, for comparison purposes, quite satisfactory. The mantle, after the collodion has been burned off, is lowered over molten wax until the tip is just immersed. The wax is left to set (three minutes being allowed exactly), and then a regularly increasing force is applied to the bottom of the mantle until it is broken. The breaking strain is provided by a suitably weighted float in a cylinder of water, the pan containing the wax (which is attached to the bottom of the mantle) being fixed to this float. The time taken for a complete test, from the lowering of one mantle into the wax until lowering in the next, is from five to six minutes.

Tests of the life of mantles made in the laboratory would probably not bear much comparison with the life *in situ*. For this test, therefore, a careful record of the mantle consumption of each lamp is kept by the various depot foremen. The life figures are then abstracted from these mantle returns, and any abnormalities carefully investigated and corrected. In practice, we are satisfied if our return of mantles used averages about three mantles per nozzle per annum.

Included in the general routine work of our test room are a number of service inspections, which, while they do not, strictly speaking, come within its purview, do most emphatically make for increased district efficiency. One of the most important of these is systematic inspection after lighting time. These inspections are made by car, and are quite independent of the routine inspections made by the recognized inspectors. This may appear superfluous, but actually they are invaluable. Two nights per week are spent hereon, one essentially dealing with gas lighting, and the other with electrics. Last year 982.1 miles were covered in this way, and the average percentage of failures, from whatever cause, was found to be 1.27 per cent. A check is kept on the time setting of time-switches and controllers. This leads not only to the detection of attendants who are careless, but also of movements which are not keeping good time. Incidentally, we have a qualified clock repairer on the staff, whose sole duty is to look after time-switches and controllers. Another point is the careful watch on all overhead wiring, and especially span wires and insulator brackets. An exhaustive record is kept of all such plant, which shows clearly when cleaning, inspection, or repainting is due. This record is of vital necessity. This paper might be extended considerably, but it is hoped that sufficient has been said to fulfil the title of it, and to prove that a test room is imperative in every public lighting department.

Modern Street Lighting by Gas

By C. I. WINSTONE and W. A. BISHOP

IN the early portion of this paper the authors trace briefly the development of public lighting by gas and survey its present position. It is recalled that gas was first applied to public lighting for Westminster Bridge in 1807, and the first street to be lighted by coal gas was Pall Mall, which was lighted in 1812. With the exception of a few years during which it was lighted by electricity, Pall Mall has been lighted by gas ever since, and has for the last twenty years been lighted by high-pressure gas lamps.

In order to illustrate how gas has maintained its position, the authors remark: There has been no extension of electric light in the streets of the City of London for over 25 years, and there are at present in use in that city over 1,800 gas lamps. In the City of Westminster there has been no extension of electric street lighting for 30 years; indeed, gas displaced electricity in a considerable area in that city in 1910. There are at present over 3,000 gas lamps in use in the streets of Westminster. There are some 635,000 gas lamps in use to-day throughout England and Wales. Some of the best-lighted streets in the world, notably Whitehall and Regent Street, are lighted by gas. Among the outstanding advantages of gas for street lighting are its reliability and freedom from breakdown, its economy, its absence of glare, the good diffusion of light which it provides and its utility in times of fog.

Street Safety and Public Opinion.

There is no need to emphasize the importance to the community, from the point of view of safety, of adequate and dependable illumination of our streets.

Motorists, pedestrians, chiefs of police, local authorities, and suppliers of the agents for producing light are all agreed that advances in our standards of street illumination are needed, and in many cases overdue. These requirements, arising from the changed conditions existing in our streets, must be met, and, for this purpose, financial support must be given. Compared with the amount of money spent on other public works, that spent on street illumination is in most areas far too small. It is not that other items of municipal expenditure are too heavy, but rather that the street illumination allotment is not large enough.

Conditions of Efficiency.

The mantle is a most important component of any incandescent gas lighting burner. Too much attention cannot be devoted to the careful testing and examination of mantles—for luminosity, durability, and correctness of shape—before making purchases. Flame temperature is of primary importance in relation to the luminous output of an incandescent burner; and it does not necessarily follow that the richest gas burns with the hottest flame. A gas of comparatively low calorific value may, by reason of the correspondingly small quantity of air necessary for its combustion, develop a flame quite as hot as that produced by a gas of much higher calorific value and larger air requirements.

Good Maintenance Essential.

Maintenance is a matter of extreme importance. Among the factors which cause progressive depreciation in the efficiency of a lighting system are: (1) Accumulations of dust and dirt on lamps and reflectors; (2) broken and misshapen mantles; (3) damaged, badly discoloured and missing reflectors; (4) replacements with mantles of incorrect size for the type of burner nozzle; (5) careless regulation.

It has been shown in regard to (1) that the loss of light due to this cause may be as high as 15 to 20 per cent. for a relatively small accumulation of dust, while in cases of neglect, where the cleaning interval may extend to from four to six weeks, the light may have diminished by 35 to 50 per cent.

Requirements of Various Classes of Street.

In approaching the question of the most suitable type of installation for any particular class of street, a number of circumstances have to be considered, and no definite rules can be laid down.

It is wise to plan the lighting of secondary roads having in mind that in ten years they may become main roads, and will inevitably be carrying a greater volume of traffic than at present. One method is to fix tall steel columns with brackets overhanging the roadway at a suitable spacing ratio with suspension globe lamps of the cluster type to take larger clusters at some future time. The lamp should be suspended from a raising and lowering gear, and should have a distant control valve in the base of the column.

Main-road lighting forms one of the most important sections of a public lighting engineer's work. One method of lighting for main roads which has been growing in popularity is the hanging of the lamps over the roadway, either centrally or from brackets extending

TABLE I.—DETAILS OF GAS LIGHTING INSTALLATIONS IN CERTAIN LONDON STREETS, AND OF TESTS TAKEN IN THEM TO CONFORM WITH B.E.S.A. SPECIFICATION.

No. of Test	Position of Installation	Date Tested	Description of Lay Out	Average Distance Apart of Lamps	Height to Centre of Mantles	Spacing Height Ratio	Average width of Road, Kerb to Kerb at Test Points	Contract Candle-Power of Lamps	Average Measured Candle-Power of Lamps	Measured Foot-Candles at Test Point	B.E.S.A. Specification Class	Max. Foot-Candles	Min. Foot-Candles	Diversity Factor	Remarks
1	Chiswick High Road ..	16/7/30	5-Lt. Bijou 10ft. per hour in 16" Square Lamps	85ft.	13ft. 9in.	6·2	34ft.	—	250	·06	F	1·24	·06	21	
2	Tottenham Court Road	16/7/30	16-Lt. Bijou Low Pressure Lamps in U Fixing	50ft.	17ft. 6in.	2·8	31ft. 3in.	500	496	·37	D	2·1	·37	5·6	
3	High Street, St. Giles, Holborn	16/7/30	6-Lt. Line Fitting Burners in Globe Lamp son Swan Neck Columns	70ft.	14ft.	5·0	20ft.	300	300	·169	E	1·85	·169	11	
4	Carlisle Place, Westminster	8/7/30	4-Lt. Bijou 8ft. per hour Low Pressure Lamps on Columns	82ft.	11ft. 6in.	7·1	24ft.	180	185	·039	G	1·0	·039	26	
5	Vauxhall Bridge Road, Westminster	2/7/30	6-Lt. Bijou 12ft. per hour Low Pressure Lamps on Columns	130ft.	14ft. 10in.	8·7	40ft.	300	318	·074	F	1·44	·074	19·5	
6	Pall Mall	2/7/30	High Pressure Gas Lamps on Tall Columns	180ft.	20ft.	9	43ft.	1800	2077	·116	E	2·20	·116	19	
7	Regent Street	26/6/30	Refuges in the centre of Road. High Pressure Gas Lamps on Tall Columns	183ft.	21ft.	9	52ft.	3000	3200	0·155	E	3·7	0·155	23·8	
8	Victoria Street ..	26/6/30	Refuges and Side Lights. High Pressure Gas Lamps on Tall Columns	125ft.	20ft.	6	40ft. 6in.	1800	2000	0·23	D	Not taken on these Tests			
9	Piccadilly	2/6/30	Refuges in the centre of Road. High Pressure Gas Lamps on Tall Columns	174ft.	21ft.	8	50ft.	1800	2040	0·134	E	„	„	„	
10	Whitehall Gas Portion Near Cenotaph	2/6/30	High Pressure Gas Lamps on Tall Columns	Very irregular	20ft.	From 3·1 to 6·5	From 70ft. to 100ft.	1800	1880	0·41	D	„	„	„	
	Near Parliament Square	„	„ „ „		„			„	„	0·6	C				

anything up to 12 ft. over the roadway. Convenient raising, lowering and traversing gear is available for installations of this type. The centrally hung system seems to lend itself particularly to high-pressure gas lighting. A good example of it will be found in Lewisham High Road; there is comparative uniformity of illumination over the whole width of the road; there is also good definition of the kerb line, which is clearly visible for some distance ahead of the drivers of vehicles. Moreover, the good diffusion of light is apparent.

In considering the relative merits of column and bracket lighting and central suspension lighting, much depends upon the width and characteristics of the road. No hard-and-fast prescription of what is best practice can be given.

Concluding Hints.

Directive reflectors designed to obtain more even illumination of the road surface should be chosen with care. Some are *too* directive.

Assuming that the lamps in main roads should be 18 ft. to 20 ft. above roadway, it is necessary to use always a constant by-pass. An intermittent by-pass might save 3s. per annum, but for main-road lighting, where the smallest details must be studied to obtain perfection, the saving is not worth it. A main-road lamp should never be fixed near a channel gully. If the lamp is there first, a gully should not be fixed near the lamp. It is costing hundreds of pounds to replace lamps that have been knocked down owing to the tilting of vehicles through running close to the kerb and over the gully. In main roads the lamps should burn on a more extended time-table than in side streets. If it is desired to extend the lighting time, but not to increase the lighting costs, this is best done by reducing the total amount of lighting after 1 a.m. to, say, half, and continuing that reduced lighting well into dawn.

Reliability.

Main-road lighting should be absolutely reliable and free from sudden failure. It is a remarkable tribute to the reliability of gas that during the past 120 years there has never been a complete failure of gas in street lighting.

There has been great demand recently on the part of the Metropolitan Police for an improvement in the lighting of the area where a point policeman is working. The most effective method is to have a centrally hung 10-light cluster globe lamp.

Regular tests for efficiency are essential, and the lighting engineer must be provided with modern instruments. Photometers for measuring direct intensities and lumeters for measuring surface brightness should be used frequently to obtain information on the performances of installations. It is impossible for the lighting engineer to carry out his work properly without them.

In conclusion, the authors referred to the gas lighting of Regent Street as an outstanding example, and illustrated their remarks by numerous lantern slides of modern installations, claiming that "during the past 120 years gas lighting has kept pace with every development in the science of illumination."

The above table gives particulars of tests in typical London streets.

Laboratory Experience in Relation to Public Lighting

(A) GASLIGHTING, *by* DR. J. S. G. THOMAS.

TWO papers were presented under the above title. The first of these, by Dr. J. S. G. Thomas, summarized the practice of the South Metropolitan Gas Company. Dr. Thomas emphasized a fact that is apt to be forgotten—that the incandescent gas burner is a scientific appliance. "Its underlying scientific principles," he said, "are realized only by very few of its manufacturers; the public generally has only the vaguest and most peculiar notions of its operation. . . . Efficient gas lighting is only possible when efficient gas appliances are used; shoddy, inefficient burners can only unjustifiably discredit the gas company."

The South Metropolitan Gas Company has given much attention to the construction and testing of incandescent burners during the last 25 years. The fundamental principle of fixed gas and air is incorporated in all the company's gas-consuming appliances, whether used for lighting or heating. All burners are made to have standard hourly consumptions of standard gas under specified standard conditions. Gas and air

adjusters are therefore not provided, for neither is necessary.

Now the efficient operation of a Bunsen burner depends upon efficient entrainment of air by the gas jet issuing at the fine hole or holes of the ejector. Maximum efficiency here is attained only when the gas issues from the injector orifice or orifices with the maximum of kinetic energy. The disc containing such orifices should be as thin as is compatible with the attainment of the necessary rigidity of construction; in fact, the diameter of the orifice is not less than about three times the thickness of the disc. In addition, the internal surface of the orifice in the disc shall impede the flow of gas as little as possible, i.e., it should be as smooth as possible. Microscopic examination of a large number of orifices in discs constituting part of burners supplied by various makers shows that this condition is rarely satisfied. Orifices are in general irregular in outline, and burs and other irregularities are present. In the original paper the author described the procedure of the South Metropolitan Company involving the punching of orifices of 0.052 in. diameter in sheets of nickel silver of a thickness of 0.0075 to 0.009 in. This is done by means of a special hand-operated machine. The internal surfaces of orifices thus produced are quite smooth. Special care is taken to ensure that the disc is truly axial. Another point that receives attention is the cremation of dust in the flame of the burner and the provision of easy access to the ejector to enable any deposited particles to be removed. The gas-air mixture is subjected to a certain amount of preheating, and the high-temperature gradient present imposes a strain at the junction of nozzle and preheater. The screw thread is therefore robust in character, the thread-counter contour is rounded off and the screw thread is glazed in order to diminish any tendency for the refractory nozzles to fracture or become tightly fixed. An essential feature of all "Metro" burners is the complete interchangeability of all burner spare parts.

The lighting efficiency of sample burners is ascertained by photometric test. The photometric bench, as described by the author, involves the use of a suitable incandescent burner to illumine an adjustable slit in a Methven screen, the light transmitted through this slit being equal to that of the Harcourt 10 candle-power pentane burner. On such a bench lamps up to 1,500 candle-power can be tested. Graduated scales reading directly in candle-power are used. In obtaining polar curves the device for elevating the lamp is connected with the photometer head in such a manner that the photometer disc is rotated through only one-half the angular elevation of the lamp; thus the angle of incidence upon the disc of light from the secondary standard and from the lamp under test is the same in all positions of the lamp, and no angle-corrections are necessary.

In conclusion, illustrations of a number of typical lamps used for public lighting were presented.

For purposes of classification, roads have been divided into four classes:—

Class 1. Main roads, being, in general, *both* tram and bus routes.

Class 2. Main roads, being, in general, *either* bus or tram routes.

Class 3. Roads carrying considerable fast traffic, exclusive of trams and buses.

Class 4. Side roads, exclusive of *cul-de-sacs*.

The lamps generally used for the illumination of these roads are:—

Class I. Either high-power high-pressure lamps spaced 50 yards apart and at height of 18 ft., in the case of main arterial roads, or 6–8 No. 2 mantle low-pressure lamps, spaced at 50 yards and at a height of 14 ft. 6 ins.

Class 2. Four No. 2 mantles, low-pressure lamps, spaced 50 yards apart and at a height of 13 ft. 6 ins.

Class 3. Three No. 2 mantles, low-pressure lamps, arranged as in Class 2.

Class 4. Two No. 2 mantles, arranged as in Class 2.

The novel features of these lamps are:—

(1) The use of reflecting mirrons of silvered glass, "stainless" or chromium-plated steel, to effect an improved distribution of illumination on the roadway.

(2) The enclosure of the pressure governor and clock controller within a case at the base of the lamp.

Particulars of the candle-power and consumptions of typical lamps are shown in the accompanying table:—

CANDLE-POWERS AND CONSUMPTION
(INCLUDING BY-PASS).

	Candle-Power.	Hourly Consumption.	
	Candles.	C.ft.	Centi-therms.
2 No. 2 in 14-in. Windsor lantern ...	170 ...	5.5 ...	3.08
3 No. 2 in 16-in. Windsor lantern ...	250 ...	7.0 ...	3.92
4 No. 2 in South London lantern ...	370 ...	10.0 ...	5.60
6 No. 2 Cradle lamp	550 ...	15.5 ...	8.7
8 No. 2 Cradle lamp	640 ...	20.5 ...	11.5
Police Traffic Control Points—			
12 No. 2 Cradle lamp	960 ...	28.5 ...	16.0
15 No. 2 Cradle lamp	1000 ...	35.0 ...	19.6
High-pressure	1000 ...	20.5 ...	11.5
,, ...	1500 ...	31.0 ...	17.4

(B) ELECTRIC LIGHTING,
By G. H. WILSON, B.Sc., A.M.I.E.E.

A SECOND paper, under the above heading, was read by Mr. G. H. Wilson (G.E.C. Research Laboratories, Wembley). In his opening remarks the author points out that the increasing demand for laboratory tests and investigations in lighting work is an indication of present-day progress. With the issue of lighting specifications accurate knowledge of the performance of lamps and fittings has become essential. An illumination laboratory has two main functions. It enabled the performances of lamps and lighting units to be studied; also, in a few cases, it offers facilities for fundamental work on physiological and physical problems (e.g., glare, visibility, etc.).

These notes embody experience gained in testing lamps, lighting units and installations. To obtain thoroughly reliable test results is no easy matter, and essential precautions are sometimes overlooked. (As an instance of omission of essential data the author mentions the exhibit of polar curves without any values of intensity being shown.)

Equipment of a Laboratory.

The most important piece of laboratory equipment is doubtless the photometric apparatus, which enables the polar distribution of light from sources to be determined. Another valuable device is the integrating photometer, by means of which measurements of total flux may be made. Useful hints on the design of such apparatus are given in the British Standard Specification No. 354 (1929). The third essential piece of apparatus is the illumination photometer, of which numerous types exist. Here again guidance is afforded by British Standard Specification No. 230 (1925). When photometric observations are made visually, variations between results of observers and fatigue effects may be expected. A recent development has been the use of photo-electric cells, which eliminate these errors. Considerable care is necessary in designing and using such apparatus; but once the mechanical and electrical difficulties are overcome increased accuracy, especially accuracy of repetition, is obtained. It is probably difficult to obtain visual accuracy in commercial photometers for illumination work greater than $\pm$ 5 per cent. With photo-electric photometers it should be possible to bring this figure down into the neighbourhood of $\pm$ 1 per cent., and frequently internal variations in the lamps themselves are greater than the maximum photometric error.

One of two main principles is usually employed in the photo-electric photometers. In one the balance is made by moving a comparison lamp until a zero galvanometer deflection is obtained. In the other the valves are arranged in a bridge circuit, and the value of a grid bias is altered to rebalance the bridge. Valve amplifiers are used in both cases.

Measurements on Incandescent Lamps.

The light distribution of a bare lamp must be known before any design work can be undertaken. This immediately raises a number of points. Even lamps made to B.S.S. 161 (1928) are permitted a ± 15 per cent. tolerance in lumens. Hence, if the results obtained in various laboratories are to be comparable, it is most desirable that when polar curves are determined the lamp should be run at such a voltage that the total lumen output is as given by the rated initial value in the specification. Before test the lamp should be aged by burning at its marked voltage for 24 hours. Any rapid initial changes are by these means completed before photometry is commenced.

As a filament does not form a complete ring the intensity will vary in different directions. Reflections from the surface of the bulb have also some influence. Hence, in order to get a representative curve, measurements in several planes are desirable; the mean of four planes is usually satisfactory, and the planes suggested by Buckley* may be used.

Measurements on Lighting Units.

The precautions suggested above may also be employed with lighting units. Tests with the average symmetric street-lighting unit are simple. Here again curves in several planes should be taken, though individual maxima may be considerably higher than the average value. Asymmetric units, which are increasing in popularity, introduce further difficulties. Complete data can be exhibited by means of an iso-candle diagram, which is in effect a contour map of intensity values. In the example shown in the original paper the shape of the lines of longitude are so selected that given areas on the diagram are proportional to equivalent areas on a sphere surface; hence, by adding the products of intensities and areas, the flux concentrated on the surface of a given street may be computed.

Tests on Street-lighting Installations.

Street-lighting installation tests made under service conditions according to the British Standard Specification are relatively straightforward. Any depreciation in units or lamps is included in the results, and no corrections are made for this factor. The only correction involved is that occasioned by the voltage having departed from nominal value. Even this allowance may be complicated in some instances, e.g., when it is necessary to allow for voltage errors on a number of lanterns situated some distance apart, all contributing to the available illumination.

Tests under rated conditions are less simple. Every lamp should first be tested. All equipment must be clean and correctly adjusted. The usual correction for voltage must be made. It would appear that in most cases rated test-point illumination values are better calculated from laboratory tests. When test-point illumination readings of illumination enable the installation to be classified, much may be learned by a complete isolux diagram.

The Design of Street-lighting Units.

Three main types of distribution of light from street-lighting units are found: (1) uncontrolled distribution; (2) controlled symmetric; and (3) controlled asymmetric. Lanterns of the first type are simple, but specially designed reflectors or refractors are necessary for types (2) and (3). Whilst a refractor can produce high intensities at angles near the horizontal with greatest ease, in the case of reflectors the reverse is usually true, i.e., high intensities are most readily produced at angles near the downward vertical. Thus there may be independent fields for reflectors and refractors. The effect of focussing may be of great importance in street lighting. Whilst a variation of even ± 10 per cent. may not greatly affect the maximum intensity, changes in focussing may alter considerably *the position* of this maximum, and to the same extent the whole shape of the distribution curve. Unless careful attention is given to focussing, the advantages of equipment giving controlled light distribution are largely lost. In the case of asymmetric units centralization of the lamp in the reflector or refractor may be of importance.

Modern developments are towards the use of non-ventilated street fittings. Dirt-collection is thus reduced. A loss of light in ventilated lanterns of as much as 29 per cent. in three months has been found to occur in smoky industrial cities. The principle of non-ventilation should, however, be applied with care, as the temperature of operation is necessarily higher. From the æsthetic standpoint there is much to be said in favour of using decorative figured glasses, but it is not easy to combine technical merit and artistic effect. Whilst a lightly stippled glass may have little effect on the action of a refractor, mottled glass may almost completely destroy this effect.

Factors Affecting the Design of Street-lighting Installations.

Considerable experience of the design of street-lighting installations has been gained during recent years, especially owing to the issue of the Standard Specification. The efforts of designers of fittings are directed towards obtaining maximum effect for a given energy consumption. But the co-operation of the installation designer is necessary in order to avoid these effects being nullified in practice. Thus, in the case of directive equipment, swinging of the unit has a very noticeable effect; directive equipment should be so supported as to avoid all swinging and rotation, and great care should be taken to ensure asymmetric units being correctly oriented. (In a few cases two-way units have been seen with the beams directed across instead of up and down the street!)

The possibilities of installations using units with a sharp cut-off, so that there is no possibility of distant units causing glare, deserve study. In some cases increased visibility may be expected. The nature of the road surface has a very important influence on the effects of street-lighting installations. The use of "model streets" in studying these and similar problems has proved very helpful.

* *Illuminating Engineer*, 1925, Vol. XVIII, p. 93.

The Lighting of Birmingham

By R. MASON

(*Public Lighting Superintendent, City of Birmingham*).

IN introducing his subject Mr. Mason remarked that it has been left to the motor car to reveal the necessity of public lighting. "Road lighting" is now quite as important as "road making." When he first entered the service, in 1886, Birmingham boasted about 7,000 public lamps and less than 200 court lamps, all of the flat-flame type. Most of these were consuming 4 or 5 cubic feet per hour, equal to a few special lamps burning 15 and 20 feet per hour, and even one or two over 30 feet per hour; but the candle-power was very poor in comparison with the excessive consumption. The introduction of the incandescent mantle was as startling as the discovery of wireless. The drawback in those days was the cost of mantles, and this naturally led to the introduction of anti-vibration devices, which continued until the introduction of inverted lighting. The transfer of the lighting from flat flame to incandescent took many years to accomplish. Long before this change had been carried out, in fact about 1904, experiments had been made in automatic lighting. Initially there was some feeling of prejudice against the use of controllers. The question arose, "What was to become of the lamplighters?" The shortage of men during the war led to a determined and successful effort to make use of controllers. The development of public and private housing estates after the war, necessitating the erection of more lamps, enabled men released by the use of controllers to find work in these new areas. Thus the adoption of this form of mechanism has not proved detrimental to employees.

After repeated experiments it was decided to adopt universally the medium-sized (No. 2) mantle. This can be satisfactorily filled with 2½ cubic feet of gas at

4 inches pressure. All lamps are fitted with governors. As district pressures varied from 3 to 5 inches, this step was found to be essential. At the present time there are 31,640 lamps, 31,145 gas lamps and 495 electric. The majority of the gas lamps are of the one or two light type, but there are sixty 16-light units and there are also 38 high-pressure lamps, each of 4,500 candle-power. The electric lamps include four of 1,500 watts, 18 of 1,000 watts and 1 of 500 watts, the remainder varying from 60 to 300 watts.

It was an old regulation that before roads could be taken over by the Corporation as public highways lamps should be provided at not more than 50 yards apart. Consequently this has been the standard on which most of the lighting has been carried out, except, of course, the important central thoroughfares, where the lamps are spaced at 35 yards or less.

The following are the general lines on which the distribution of the lamps of various capacities is based:—

Situation.	Capacity of lamps used.
Important central streets and large open spaces	8 and 16 lights.
Tram routes and main roads ...	4 lights with 6 lights at "stopping places" and "crossings."
Bus routes, arterial roads and "cross traffic" routes ...	2 lights with 4 lights at "stopping places" and "crossings."
Ordinary side roads	1 light with 2 lights at corners, and lamps opposite other thoroughfares.

It is intended to make the two-light lamp the minimum capacity for street lighting and to have at least four-light lamps on all bus routes and "cross traffic" routes.

Another problem has been the increasing of the heights of the light source. When lamps of a higher candle-power are used, full advantage can only be obtained by raising the light source. This has been done, in some instances, by the introduction of an extension piece to the existing column; in others a large swan-neck bracket has been fitted. Undoubtedly a better method is the substitution of some of the new types of columns now specially designed for street lighting. Unfortunately, this is a very costly alteration. In the case of some tram routes the difficulty has been overcome by removing the lamp columns and substituting a 6-light lamp on a tram pole 18 feet high. High-pressure gas lamps are erected in and around Victoria Square. The columns average 18 yards apart and the height is 18 feet. As these lamps yield 4,500 candle-power the conditions leave little to be desired. Electric lamps are used near the Hall of Memory and along part of Broad Street. Illumination diminishes gradually as one changes from 1,500 to 1,000 and then to 500 watt lamps. The columns here are 25 yards apart, mounted on the alternate system at heights of about 21 feet.

Birmingham is remarkable for the number of its traffic islands. These are lighted by a central lamp supported by two amber lamps at the side. There are at present 520 such islands in the city, and they have been found most useful by the police. The Department has also been of assistance to traffic by the making and erection of special warning signs ("Drive Slowly," "Dead Slow," "Danger—Narrow Bridge," "Low Bridge," "Drive Quietly—Illness," etc.). These are of the reflecting-box type, which enables the ruby letters to be illuminated by the action of mirrors at the back of the box. The "Cross Road" sign, designed by the Ministry of Transport, has been constructed on a similar principle.

Public Lighting as Viewed by the Motorist

By H. STURGESS-WELLS, J.P.

IN dealing with this "vexed question," the author emphasized the prevailing sentiment amongst motorists, that streets should be properly lighted or not at all.

"All motorists," he said, "know what a dreadful trial badly-lit roads are, and what a strain it is when driving at night to be for ever wondering whether something ahead on the road is merely a shadow or a pedestrian. A motorist feels safer in unlit roads, relying on his own headlights, than without them on roads intermittently lighted by public lamps without order as to position or spacing, or semblance of system quickly discernible by the 'man at the wheel.'" A motorist taking a journey of 50 miles may pass through areas controlled by 20 different authorities (there are 326 civil parishes in the County of Leicester), each having its own ideas on lighting. "Some sections of the highway may be supplied with a few oil lamps suspended at odd corners of streets only, other areas may have gas lamps with bare burners or 'incandescents' dotted here and there (*possibly alternately, on a winding road, causing the motorist to lose all sense of direction if relying on them*), while others may have electric standards at regular spacings on one side of the road only, with part of their illumination obscured by trees planted too closely before (in the council's over-towering judgment) the 'rateable value' of the particular road was deemed sufficient to have perhaps any public street lighting at all."

Proceeding, Mr. Sturgess-Wells remarked on the overshadowing effect of trees on high lining highways and to the fact that immediate revenue from rateable value too often spoils the carrying out of desirable lighting schemes. He recalled the efforts which he had made in the past in endeavouring to induce the parish council to adopt incandescent in place of flat-flame gas burners. He thought that uniformity of highway illumination was one of the crying needs of the present time. Both as regards highway lighting and the lighting of motor vehicles this was probably a period of transition. At present there appeared to be no co-ordination amongst local lighting authorities. "A rural authority possesses not the power to remove a kerbstone, but may plant street lamps of any standard in any old position it may think well—it can light up a parish pump but may ignore dangerous cross roads! Smaller authorities should confer with its larger neighbouring authority before installing lighting systems. A notable omission has been made in the new Local Government Act of 1929, which transfers to county councils control over *highways, but apparently no power to deal with lighting.*"

The existing conditions place a heavy responsibility on public lighting engineers which is accentuated by omissions on the part of the "powers that be." As instances the author mentioned the practice of "walking to the common danger," and the lack of provision of adequate side-walks, definite crossing-places for pedestrians, and safety zones.

In the second portion of the paper Mr Sturgess-Wells replied to a series of queries that had been put to him regarding the effect of various lighting conditions on the motorist. Referring to methods of street lighting in use in Leicester, he said that he preferred the overhead central system, which by the regularity of the line of lights was of material assistance to fast-moving traffic, as well as giving uniform illumination on the roadways. He preferred gas lighting because of the better dispersion of light without the exaggerated bright patches which he had observed from electricity. He considered momentary blinding a possible contributory cause of accidents, but did not think that such objectionable glare was in evidence in the streets of Leicester. He did not agree, however, that there was sufficient illumination to render "objects, stationary and moving, completely and sharply visible."

Amongst objects not sufficiently revealed he mentioned: (*a*) pedestrians darting from behind tram cars; (*b*) pedestrians who step suddenly off the pavement into the roadway; (*c*) cyclists without rear-lights; (*d*) cattle, cats and dogs.

He agreed that, generally speaking, headlights were not necessary on the main roads of the City of Leicester. He himself made a practice of not using them. In so doing it might be that he took some little risk, but he knew the roads of Leicester and generally travelled slower by night. He thought the lighting of motor vehicles should be more fully regulated by law. "Dip and swivel" headlights were safest for night work. He did not know why this system was not recommended in the Road Traffic Bill; perhaps something would be said about it in the Highway Code now being framed. The practice of "dimming" or switching-off headlights when meeting other cars was a dangerous one; more attention should, however, be paid to the proper setting of headlights so that they are not in the direct line of vision of drivers of approaching cars. Actually, although the Ministry of Transport has power over the lighting of motor and other vehicles, it is passing strange to say that it has up to the present no control over public lighting!

Traffic signals should, wherever possible, be in the centre of the roadway, either on an island or suspended. It would also be an advantage for an electric bell to be rung when yellow light flashes. Tramway stop-lights, being of the same colours as the traffic signals, had been the subject of some confusion. But it was rumoured that in future they would be blue and white instead of red and green.*

Discussion

The discussion naturally turned very largely on the functions of testing laboratories, with which most of the papers had dealt. Mr. J. F. Colquhoun, after giving his experience of the value of such laboratories, remarked that the form in which the question should be regarded by authorities was not whether they could afford to have a laboratory but whether they could afford *not* to have one! Mr. Langlands mentioned some experiments conducted in his laboratory in Glasgow which had led to an annual saving of £30,000. Bailie MacDougall, of the same city, mentioned another respect in which laboratories were useful, i.e., their educational influence on ratepayers when they paid a visit. Mr. Stewart pointed out that they offered a valuable opportunity to young men of entering the profession. Assistants frequently acted as a liaison between the department and the manufacturer. Some discussion ensued regarding the position of towns or areas such as could not afford a laboratory; it was suggested that a central laboratory might serve the needs of several adjacent districts.

From the discussion of laboratories it was a natural step to the consideration of laboratory tests and the comparison of them with tests of lamps *in situ*. Instances of discrepancies, e.g., those arising from differences in voltage at the laboratory and at the point where public lamps were situated, were mentioned. Mr. Haydn T. Harrison expressed a strong preference for tests carried out with the lighting unit in its actual position; by this means its actual performance could be studied, whereas it was conjectural how far laboratory tests represented practical conditions.

Various problems mentioned in the paper as side issues aroused interest. The beneficial effects of "daylight" lamps on visibility, suggested in one of the papers, was not endorsed by Mr. Harrison, who pointed out that daylight effects, besides being cheerless, involved cutting off light that was badly needed; one missed the mellow yellow rays thus lost. Some difference in opinion was expressed regarding the merits of central suspension. Mr. Woodward argued that, as the lamps were in the direct range of vision down the street, the adoption of lamps at the side instead virtually halved the glare. Mr. Brydges, on the other hand, thought that central suspension was the best system. Several speakers agreed that the "complete cut-off" was unacceptable to the man in the street, who liked to be able to see the light. The application of reflectors of stainless steel, etc., to gas lamps, mentioned in Dr. Thomas's paper, met with approval. One other curious point may be mentioned—the suggestion, made, we believe, by Mr. Woodward, that a salt atmosphere, such as one finds at seaside places, may tend to accentuate the collection of dust in burners; one would like to know how far this is confirmed by experience.

* Apparently this matter has been since taken up by the Automobile Association. It is understood that the red lights, which were the main source of confusion, are now to be replaced by green ones with an orange band.

The Business Meeting

At the business meeting appreciation was expressed at the issue of the annual report, with its final summary of developments in street lighting in various cities. Some discussion ensued regarding the four sub-committees proposed in the presidential address. It was ultimately decided that the appointment of these four sub-committees, who should have power to co-opt additional members, should be left to the Council; it was agreed, however, that gas and electricity undertakings should be equally represented.

Colonel C. H. Silvester Evans, hon. general secretary of the International Illumination Congress (1931), referred briefly to the gathering in Edinburgh a year hence, when the 8th annual meeting of the Association would be linked with the meeting of the Congress, and a number of papers on street lighting would be read. Councillor McKechnie (Edinburgh) intimated the intention of the Edinburgh Town Council to entertain the visitors, and explained that Mr. Beveridge, inspector of lighting and cleansing in Edinburgh, and the president-elect of the Association would supervise the arrangements.

The President mentioned that, to the general regret, Captain W. J. Liberty was resigning the hon. secretaryship of the Association. Arrangements had, however, been made whereby Mr. J. S. Dow would become hon. secretary.

The Street-Lighting Tests

The street-lighting tests, arranged by the National Physical Laboratory in conjunction with the Illumination Research Committee of the Department of Scientific and Industrial Research, proved quite entertaining. Various alternative arrangements had been contrived, several lighting devices being accommodated on each mast and five similar spans provided. Arrangements were made whereby two installations could be lighted up in succession and compared, each being indicated by a red or green light, whilst a bold placard announced the number of the test (there were 12 altogether). Visitors were asked to determine and record on their card which of the two installations was most glaring, and in which the lights interfered most with visibility; other questions were framed to ascertain whether glare gave rise to discomfort, which installation was preferred in respect of general appearance, etc. The installations were so arranged as to give the same average illumination, but their nature varied widely, some installations having the light source completely cut off from view, whilst in other cases no attempt was made to screen the bare lamp. The tests continued until the early hours of the morning. Fortunately, except for mistiness in the later stages, the conditions were good. The analysis of these records should enable some interesting inferences to be drawn.

A word of thanks is due to Dr. Walsh, Mr. Stiles and the others associated with the National Physical Laboratory who spent so much time and effort on making the preliminary arrangements, and to the staff of the Leicester Public Lighting Department for their co-operation, which contributed so greatly to the success of the tests. Everything possible was done to facilitate the work, even a corps of cyclists, whose movements were of considerable assistance in judging visibility, being provided.

POPULAR & TRADE SECTION

COMPRISING

Installation Topics—Hygiene and Safety—Data for Contractors—Hints to Consumers

(The matter in this section does not form part of the official Transactions of the Illuminating Engineering Society and is based on outside contributions.)

The Shop and Display Lighting Campaign

IN previous issues we have referred to the important campaign on the above subject which was launched by the E.D.A. and E.L.M.A. last month.

The results of the survey of shop lighting* should prove extremely interesting. Whilst there has, during recent years, been a great improvement in shop lighting, we quite expect that the survey will show the need for educational effort, such as will in fact be exercised whilst the campaign is in progress. The excellently illustrated booklet, "How to Light the Modern Shop," should prove an eye-opener to many traders, and the companion leaflet, "Profits from Lighting," sets out the direct benefits to be derived from good window lighting in this "age of display." One can scarcely emphasize too strongly the advertising value of a well-lighted show window—there is no other advertisement quite in the same class, bearing in mind the outlay, and the dominant consideration in the mind of the merchant should be how to make the very best of this precious space.

A highly interesting element in the campaign will be the shop-lighting competitions. A campaign trophy, comprising the figure of the "Lady of Light," mounted upon a glass bowl filled with coloured luminous glass spheres, forms the chief award. This is of the value of about £20.

We understand that the following points will be taken into consideration when judging the efforts of competitors:—

1. The type of lighting equipment in use in the window, whether modern or obsolete. Glaring light source will be penalized.
2. The intensity of lighting employed.
3. The concealment of lighting equipment.
4. The use of luminous features in the window display, such as lighted backgrounds, luminous display equipment, lighted table standards and floor standards, or the use of lighted ornaments.
5. The use of coloured lighting to obtain special effects, and the use of spotlights to give emphasis to certain features in the display.
6. Facia lighting.
7. Other outside display lighting features, such as the outlining of the shop building, decorative lighting features on the façade, and flood-lighting.
8. The use of illuminated signs. (These may vary from the small trader's signs to large display signs across the building front.)

Attention to these points will ensure that skill in arrangement, apart from mere lavish display of light, will be taken into consideration, and every opportunity is offered for the exercise of ingenuity in supplementary lighting. It is suggested that the judge in any local competition should be an independent expert.

* See *Illum. Eng.*, August, 1930; p. 205.

Special meetings of the E.D.A. circles have been held in a number of towns. The survey is already being developed in 85 supply areas. Every effort will be made to raise the general standard of shop lighting, and to stimulate references to lighting in the local press. The aid of local organizations, such as chambers of commerce, chambers of trade, rotary clubs, civic week organizers, local display associations and sales managers' associations, will be enlisted, and arrangements will be made to organize special shopping weeks, or other local festivals, during the period of the campaign (September to December).

Shopping weeks, trade exhibitions and electrical displays have already been definitely fixed in many of the chief areas. It is estimated that quite 200,000 shops, approximately a third of the total number in the country, will be circularized, and it is expected that quite 50,000 shops will be approached through the medium of local E.D.A. circles.

In conclusion, we may recall again these salient "lighting facts" mentioned in the E.D.A.–E.L.M.A. programme:—

(1) Only one shopkeeper in eight uses an outside electric sign.

(2) Less than one shop in a hundred makes use of an illuminated facia.

(3) Only one shop window in ten is provided with a 100-watt lamp or its equivalent per foot run of window.

(4) Only 50 per cent. of the shop windows throughout the country are furnished with modern lighting equipment.

(5) Only one shopkeeper in five is making use of after-hour lighting.

(6) Only one shop in twenty has illuminated showcases.

Lectures on Illumination for Contractors

We understand that a course of six lectures for contractors will be held at the E.L.M.A. Lighting Service Bureau this autumn, on Monday evenings, commencing on October 13th. Whilst this is a general illumination design course, such subjects as shop lighting and display lighting will receive special attention, in view of the autumn campaign on this subject.

Those interested in this course of lectures are invited to communicate with the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, London, W.C.

CONTRACTS CLOSED.

We are informed by Messrs. Siemens Electric Lamps & Supplies Ltd. that contracts for twelve months' supplies of Siemens Electric Lamps have been placed by the General Post Office and the Southern Railway.

The "Haus der Technik," Berlin

ARTIFICIAL light tends to play a continually more important part in daily life. Workshops, offices, schools, shops and streets, etc., all present special problems. Efforts are therefore being made to demonstrate to consumers not merely the variety of fittings and lighting appliances available but the best methods of using them in the solution of these diverse problems.

This tendency towards the establishment of demonstration centres is well illustrated in the equipment of the "Haus der Technik" of the A.E.G. in Berlin, of which Dr. Hans Koch, of Vienna, has kindly sent us an illustrated description. The outside of the building (see Fig. 1) illustrates the use of modern illuminated signs, especially of the tubular type, as an element in "light-architecture." As darkness comes on these luminous devices stand out vividly. Show windows on either side also illustrate applications of light.

Within the house typical lighting fittings for all purposes are shown (Fig. 2); on the left are seen units for interior lighting separated one from another by sufficient space to enable their qualities and the nature

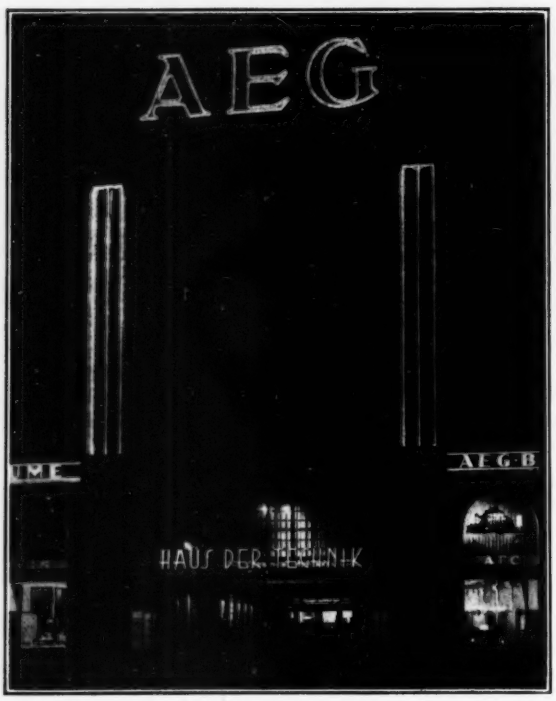


FIG. 1.—The frontage of the building, showing designs in luminous tubes, etc.

of the distribution of light to be judged. When any unit is switched on, translucent diagrams below are simultaneously illuminated; these illustrate further the light-distribution and main uses of the fitting. In an adjacent booth, seen on the right, is a table likewise illuminated, showing the effect of different kinds of glass on efficiency and cost.

In a similar manner to the demonstration of fittings for offices, schools, drawing offices, etc., special lighting units for industrial installations are exhibited. Finally, on two further walls of the room, street-lighting units are shown. Various fittings are also mounted on the ceiling, so that their effect in lighting an interior may be separately studied. Direct, indirect and semi-indirect units and also artificial daylight can thus be displayed.

FIG. 2.—A general view of Demonstration Room showing a representative collection of fittings on ceiling, control table in left-hand corner, and booths containing other fittings spaced round the walls.

Special attention is also paid to demonstrations of typical lighting problems. Thus there are two demonstration show windows, one equipped with mirror reflectors, the other with enamelled reflectors; here again the lighting-up of either of these systems is accompanied by the display of tabular data giving

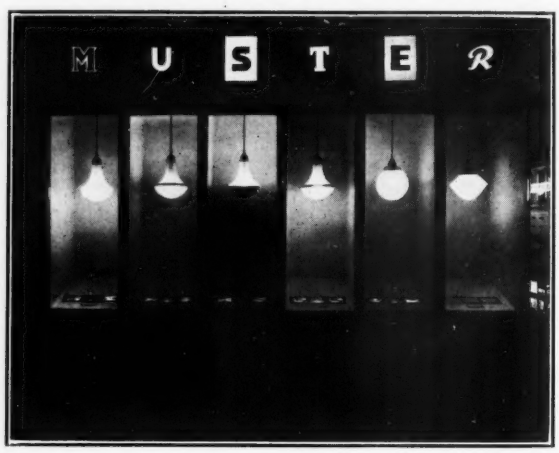


FIG. 3.—Showing booths containing typical fittings with illuminated descriptive diagrams under each.

particulars of costs of installation, energy-consumption and the illumination furnished. The use of illuminated devices bearing the names of firms and utilizing light of various colours is illustrated. Typical fittings of various periods are shown in great variety, a feature being the use of central control tables, by the aid of which any individual fittings can be put into operation.

FIG. 4.—The Fittings Showroom on ground floor.

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Some Novel Developments in Lighting in Berlin

By an Engineering Correspondent

THE various applications of good lighting are being taken up in Germany, as the following examples will demonstrate, in a very active manner—in a measure, doubtless, the outcome of the "festivals of light" which took place last year in so many cities in that country. There is evidence of a desire to take full advantage of so attractive and inoffensive a medium of creating exhilaration. Although in much that is publicly visible in the way of effective and attractive illumination one can trace the influence of local surroundings, habits and climate, there still remains much of general interest and value.

Considerable originality is shown in the lighting of many restaurants, kinema theatres, etc., in Berlin. Some of these schemes are novel, almost fantastic in execution, but others are of a restful and more permanently interesting character. Perhaps the Zoological Gardens, situated well in the centre of the town, afford a particularly good example of a method of lighting that is at once restrained and original.

A series of green-painted columns terminate in lily-shaped indented white chalices, green-lined on their projecting edges, and reflecting light from lamps concealed in the opaque petals of the supposititious plants. The illustration (Fig. 1), from a photograph taken on a wet night, indicates the pleasant distribution, and also the effect of the two columns built up of tinted-glass bricks containing a number of lamps.

FIG. 1.—View in Zoological Gardens, Berlin, showing the luminous lily standards and glass-brick columns. (*By courtesy of "Licht und Lampe."*)

The other picture (Fig. 2) is of the dancing pavilion, provided with a semi-indirect central suspension fitting, surrounded with a number of twin serpentine luminous tubes. The dance floor is translucent, and provided with lamps which, together with the central fitting, can be connected to a motor-driven switch that sends current alternately to the upper and the lower light-source in rhythm with the dance music.

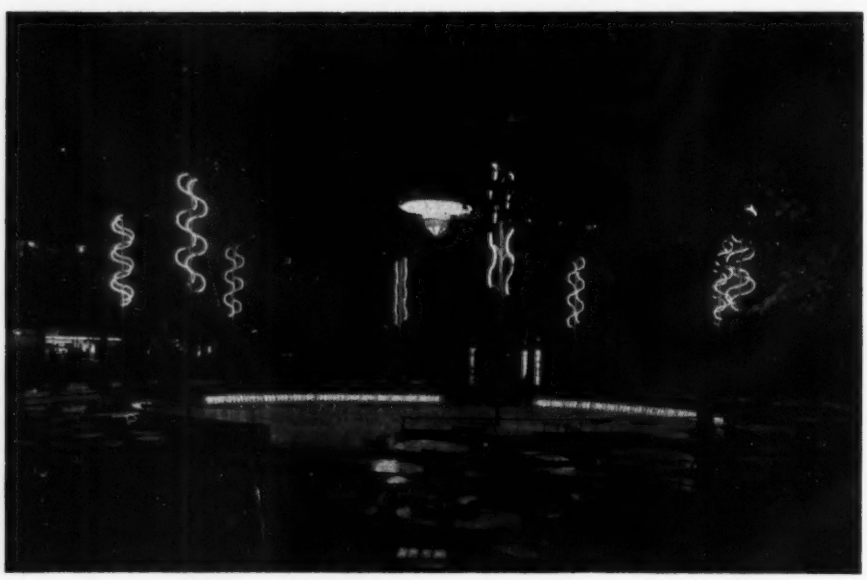
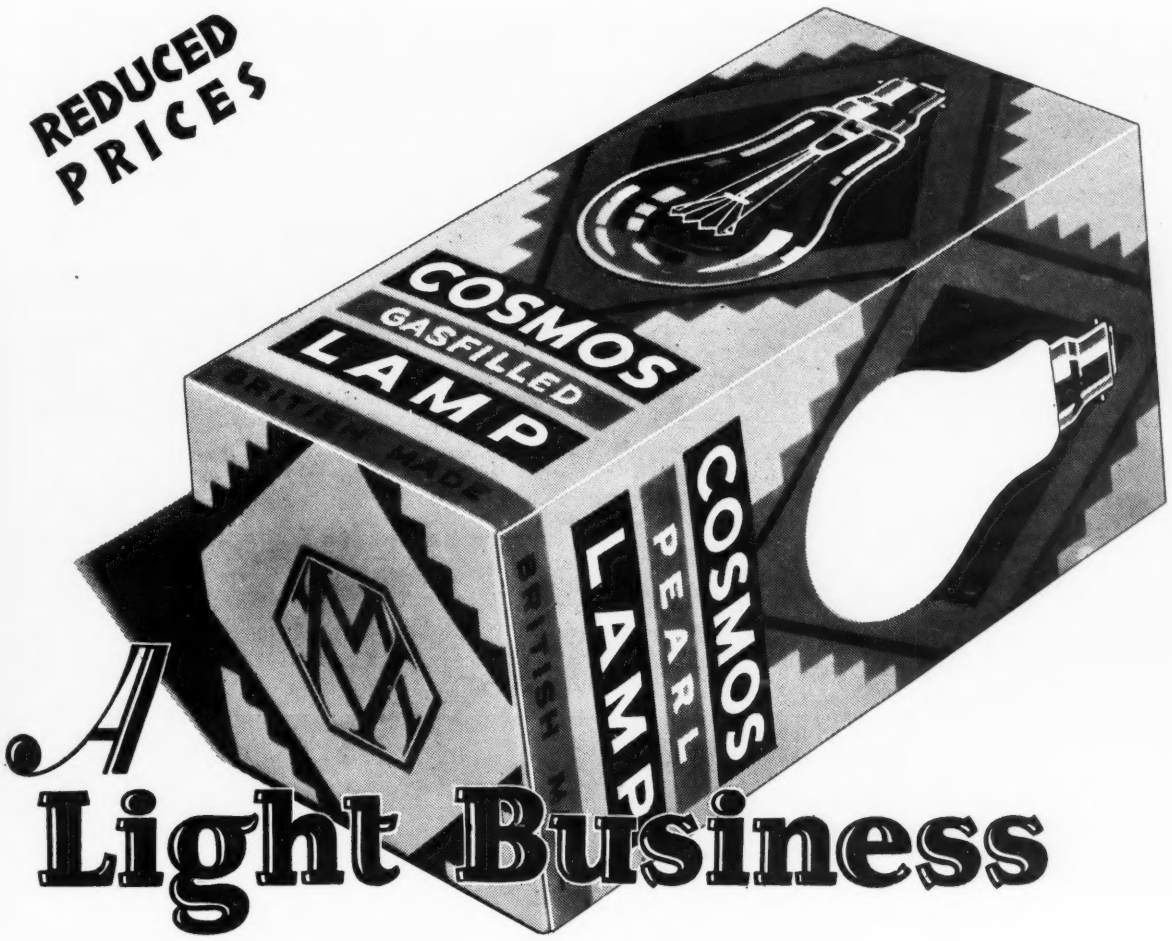


FIG. 2.—Open-air dance platform in Zoological Gardens, Berlin, showing the luminous floor, serpentine pillar lamps and overhead diffusing unit. (*By courtesy of "Licht und Lampe."*)

A feature of recent lighting has been the adoption of sources of considerable power on high masts. Berlin is in possession of a speedway (the "Avus") restricted to passenger automobile traffic, with no speed limit, connecting the city, near the new exhibition territory, to Potsdam. This has hitherto been unlit, but recently a system of lighting has been erected on a section of this for experimental purposes in connection with thoroughfare lighting. Masts at considerable intervals are provided with two high-level (48¾ ft. high) and two low-level (16¼ ft.) projectors facing opposite directions, fitted with screens so arranged that direct light does not enter the driver's eye. It is hoped by this means to render the speedway free from the results produced by headlight glare, and available for car tests, or races, after nightfall.

The prevalence of the flame arc lamp for street lighting is a striking feature, at the present time, of Continental cities, owing, it may be, to the more common habit there of placing the street-lighting sources at good elevations or permitting them to be centrally suspended over the traffic ways. The main thoroughfares of Berlin are good examples of this. Our illustration (Fig. 3) shows the Thiergarten side of the famous Brandenburgher Tor which terminates Unter den Linden, where six 30-amp. Dia-Excello lamps, erected at a height of 56 ft. on handsome masts 130 ft. apart, provide illumination for an area of 50,000 square ft., with a mean of 2 foot-candles, rising up to 4¾ beneath the lamps. An immense flow of traffic now traverses this area, and it was interesting to observe the absence of heavy shadows and the clear vision of the sides of the omnibuses or tramcars and read their destination inscriptions.

The cost of operating these lamps, including trimming, has been found here, and in adjacent and other parts of this city, to be most favourable, and this



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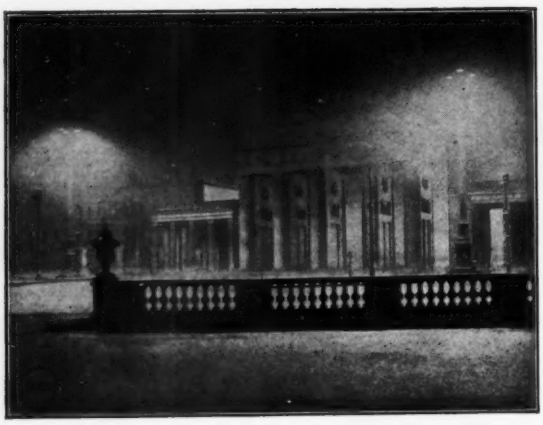


FIG. 3.—The Thiergarten side of the Brandenburgher Tor, Berlin, illuminated by Dia-Excello arc lamps on tall masts.

FIG. 4.—Façade lighting of the Wertheimer Store, in Leipziger Street, Berlin, by Dia-Excello arc lamps.

has encouraged a recent extension in the Schöneberg High Street, where 90 similar arc lamps have been installed at 130-ft. spacing, suspended 31 ft. above street level, producing an average illumination in the street (114 ft. wide) of 0.7 foot-candle, with a diversity ranging from 3¼ beneath the lamps to 0.3 as a minimum.

Floodlighting has also met with a large degree of appreciation, especially for commercial houses like the great store of Wertheim (Fig. 4), in the Leipziger Street, where 43 similar arc lamps, of the same current rating as near the Brandenburgher Tor, are suspended on brackets spaced 26 ft. apart, and, with the arc 66 ft. above the pavement level, give on the ground level of 6 foot-candles an illumination of such magnitude that the street lighting, which is by 15-amp. arc lamps suspended 38 ft. above street level, at 95 ft. spacing, does not noticeably affect the façade illumination when it is switched off or on.

The signal lighting of aerodromes is a matter of great interest in Germany, where there are so many cross-country services and landing-places, with the result that the Osram Lamp Company are carrying out experiments with tubes filled with a considerable range of gases such as sodium, nitrogen, neon, etc., and with currents up to 200 amperes. In this company's laboratory a colour-true artificial-light unit was also seen in which a mercury-vapour tube was operated in series with incandescent lamps, and giving at the normal voltage a closer approach to true daylight than any source except the pure carbon arc with correctly proportioned carbons.

The travelling circus, of any great size, is now unknown in this country, but still is of importance in sparsely populated lands, and the illustration given is of the interior of the Sarrasani Circus (Fig. 5), lit with strings of lamps with 8-in. spacing, interrupted at regular intervals by coloured globes, all supplemented by "intensive" fittings projecting light free from glare, and almost entirely from shadow effects, on the performers. When this enormous peripatetic organization pitched its tents in the Tempelhof Feld the wide entrance frontage was picked out by thousands of small lamps projecting a daylight degree of illumination around the neighbouring space.

Traffic control by automatic signal lamps is much in vogue. As yet it can hardly be considered a complete success, as there is a general complaint of the slowness of traffic in the main streets, where one is compelled to wait a mechanically allotted time, although there may be no other vehicles present.

FIG. 5.—The general and decorative illumination of the Sarrasani Circus. (*By courtesy of "Licht und Lampe."*)

As a final example of recent developments, one might mention domestic-lighting fittings, constructed so that the only exposed parts are of glass or porcelain, maintained free from hollows and "quirks." These types of fittings are proving more popular, as well as hygienic, whilst the new regulations intended to protect consumers against shock are raising the price of other designs.

(We are indebted to *Licht und Lampe* for the use of the illustrations appearing in Figs. 1, 2 and 5, and to Messrs. Korting & Mathiesen Electrical Ltd. for the two remaining illustrations.)

Lighting for the Future

In a paper recently read before an architectural lighting conference held in the United States, Mr. Ward Harrison forecasted some probable lines of development in lighting in the future—the distant future. He did not believe that windows would disappear completely from buildings, but they would become "something to look out of." Where there was no outlook of value there would be no windows. Very much more dependence would be placed on artificial lighting than in the past. Even to-day one could enumerate many rooms that have no windows. This is an indication of future practice.

Incidentally, Mr. Ward Harrison recalled that many early buildings, such as the Greek temples, made little deliberate effort to secure access of daylight. To-day "built-in" provision for daylight is usual. In all save the industrial and purely utilitarian fields the artificial lighting of the future will be "built-in" lighting.

The task of the lighting engineer in the future will be more difficult. Architects will become enthusiastic exponents of the art of building lighting equipment into their structures. Installations will vary. Each will present an individual problem; recommendations on a general or wholesale basis may no longer be practicable. Possibly this movement may help towards the evolution of the long-awaited opportunity for the independent consulting specialist in the lighting field.

TRADE NOTES & ANNOUNCEMENTS

A SPECIAL PROBLEM IN STREET LIGHTING.

A somewhat special problem was recently encountered by a London borough, i.e., the effective lighting of a number of important points by means of the source which had to be mounted on the bracket, but nevertheless to stand well out over the roadway. It was decided that effective lowering arrangements should be incorporated to facilitate cleaning and maintenance. It was also arranged that the lamp was not only to be lowered but brought to the side, close to the footwalk.

An unusual design of Bracket Fitting equipped with traverse lowering gear by the London Electric firm.

The resulting design is shown in the accompanying photograph. The pillar comprises a weldless steel post in three sections, shrunk together and having weathered joints, the long extension bracket clamped on about 2 feet from the top, the projecting portion being approximately 9 feet. The horizontal arm of the bracket is of still steel tubing secured to malleable clamp gripping the post and with an inclined stay and clamp above the bracket. Ornaments as shown are also provided. In addition there is a clip-on fluted cast iron base.

A stiff steel bar in the form of a tension member is strained immediately under the bracket tube, and this serves as a runway for the travelling trolley which carries the lantern. A double pulley is fitted near the post end of this member and the operating ropes pass over same from the trolley to the winch, which is clipped on to the pillar in a convenient position near the ground. The winch has a double barrel, each barrel being controllable separately or both together.

The traverse lowering gear is of The London Electric firm's latest pattern, and enables the lamp to be lowered at any point along the runway, and, as indicated above, this will normally be by the kerb. The lamps are controlled by a 14-day clock, which is interposed between the suspension gear and the lamp. The piping has been neatly carried out, running through the column and under the bracket to the fixed portion of the lowering gear.

The equipment was supplied by the well-known gas engineers, Messrs. Wm. Sugg & Co., Ltd., of Westminster, and the lamps are of their Rochester (Metro) 6-light pattern. The photograph is reproduced by the courtesy of The South Metropolitan Gas Company.

HOLOPHANE REFRACTING PLATES.

We learn from Messrs. Foster & Pullen, Ltd., that a considerable amount of attention has recently been devoted by them to the application of Holophane Refracting Plates to gas lanterns. In addition to the familiar square type of lantern these plates have recently been applied to inverted lamps of the suspension type. Trial installations have already been made in a number of towns, and it is expected that this device will become more widely known during the coming season.

" STRIP " LANTERNS.

Another novelty introduced by Messrs. Foster & Pullen is the " Strip " lantern, having mantles in alignment. Burners so arranged have been in continually increasing demand, owing to the convenient distribution of light for public lighting, which is preferred to that yielded by cluster burners. Hitherto "alignment burners" have been usually fixed in lanterns of more or less orthodox design, i.e., they have merely replaced cluster burners with no alteration in the lantern beyond a modification in the shape of the reflector and ventilating funnel, a method which naturally imposes limits on the size of alignment burners.

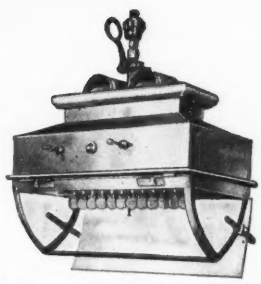


FIG. 1.—Strip Lantern, Pendant Type.

Both types utilize a series of mantles in alignment.

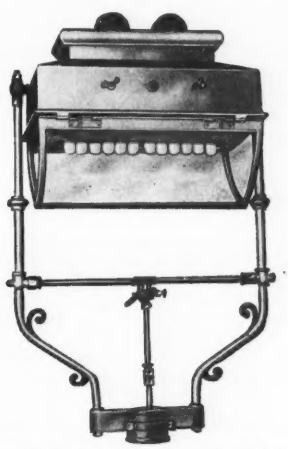
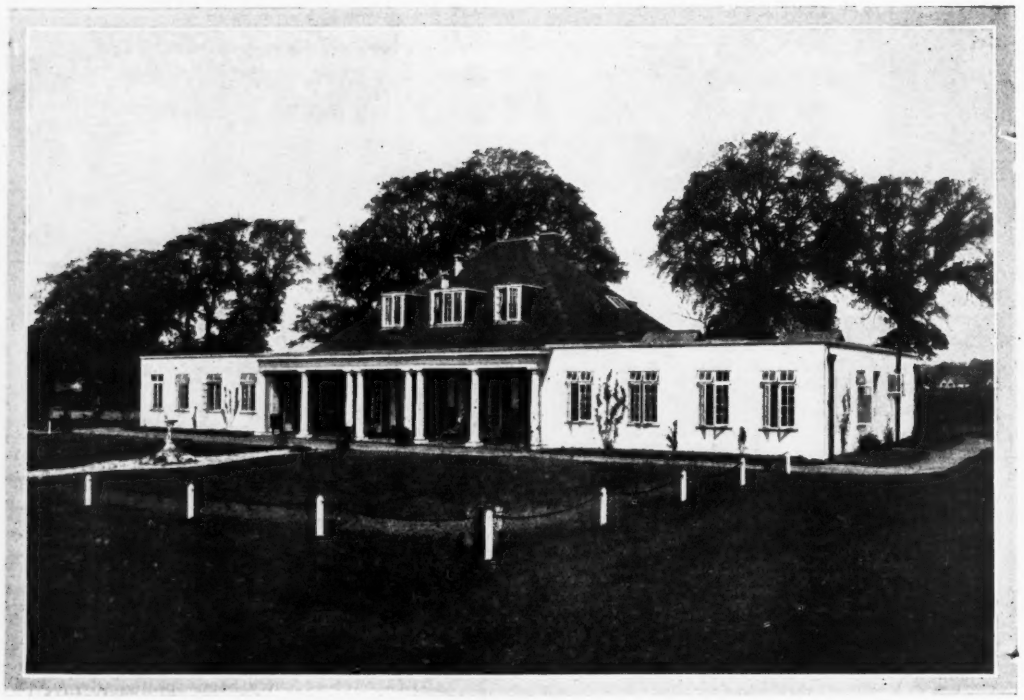


FIG. 2.—Strip Lantern with " U " Bracket.

The " Strip " lantern has been introduced with the object of overcoming these defects. The shape permits the use of burners in alignment of various sizes and in practically any combination required in streets for midnight reduction purposes. The heat-resisting glass is fixed in a rounded " V "-shaped frame and each piece can be renewed separately. In this way the lantern can be kept within comparatively small dimensions, and even the twelve-light type is quite compact. These lanterns may be suspended or fixed in " U " brackets. The former is likely to be particularly widely used. When furnished with an adjustable side reflector it becomes an effective device for window lighting; or the reflector may be replaced by a lettered tablet for purposes of advertisement. In one district the side reflector has been found very useful to concentrate the light over officers on point duty.



Gas for Cooking, Heating, Water Heating and Lighting in the Club House of the Ealing Golf Club

THE course of the Ealing Golf Club is situated in beautiful open country in the Lower Trent Valley, between Ealing and the old village of Perivale. It was originally a stretch of pleasant meadowland famed for the luxuriance of its grass.

The club house is an attractive building and has recently been equipped on the most up-to-date lines.

A coke boiler provides hot water to radiators placed in various parts of the building. Modern radiant gas fires, specially chosen to harmonize with their surroundings, are fixed in all of the principal rooms. " Ruud " gas water heaters heat up the water required in the kitchen, at the various hand basins and in the steward's private rooms.

Gas has also been chosen for the lighting of the building. The accompanying illustrations show views of a few of the more important rooms in the club house. For the lighting of the larger rooms Sugg's " Unique," " Bon Marche " or No. 7,179 aluminium lamps, or 3-light super-heated cluster burners, have been chosen. For corridors, landings, telephone boxes and the smaller rooms in the buildings, such as the ladies' committee room, the secretary's room, the card room, the larder and wine stores, and the steward's private apartments, single-burner gas fittings, with silicaware or supastone globes are used.

The architects of the building were Messrs. H. T. Goodwin, A.R.I.B.A. and J. F. Chapman, F.S.I., 43, Old Queen Street, Queen Anne's Gate, S.W.1.

The dining hall of the Ealing Golf Club is lighted by six 3-light " Unique " gas lamps with opal shades and bowls fixed on pendants finished in oxidized copper. The lights are so arranged that they can be turned on and off in pairs from a point near the door. On each side of the gas fire there is an attractive " Everite " gas candle bracket.

Part of the smoking room, showing the five 3-light "Unique" lamps used for its illumination. The "Cinderella" gas fire when alight resembles glowing coke.

The lounge is lighted by four 3-light super-heated gas burners with silk dome shades in old gold, fixed on oxidized copper pendants.

A corner of the card room showing one of the two single-burner gaslighting fittings with Vitreosil globes which are used to illuminate the room. The room is heated by a modern gas fire.

MORE LAMP PUBLICITY.

We have received from Messrs. Siemens Electric Lamps & Supplies Ltd. particulars of the firm's advertising campaign for the coming season, which includes extensive press advertising (display advertisements will appear in more than 50 different trade journals), window displays, showcards, overprinted price lists, etc. A leading feature of Siemens publicity is the famous "Popular Pair," illustrated in the accompanying picture of a window display. The same figures appear (in different attitudes) in the posters and showcards.

The lamp catalogue for the season 1930-31 is very complete, many special varieties of lamps being illustrated (some in colour), as well as the standard types. Two specially useful lines are the neon lighting and indicator lamps and the gas-filled projector lamps for cinematograph projectors, etc., which are listed up to 1,000 watts.

Further specimens of publicity literature relating to Mazda lamps have also reached us. An attractive design is that featuring Mazda lamps at the following prices: 15 watts, 2s.; 25 watts, 1s. 10d.; 40 watts, 1s. 10d.; 100 watts, 3s.; which are being offered by all E.L.M.A. manufacturers. The range of lamps for ordinary domestic purposes has thus been reduced to under 2s.

STREET LIGHTING SPECIALITIES.

We have received from Messrs. Korting & Mathiesen Electrical Ltd. copies of a series of leaflets which are of considerable current interest to public-lighting engineers. Well-illustrated leaflets deal with the Kandem, Kandem "Throlite," "Mirrorlite" and "Farlite" lanterns, and a descriptive article, reprinted from *The Municipal Journal*, contains an effective illustration of a street in Amsterdam illuminated with concentrating reflectors. We notice also a striking illustration showing the successful application of Kandem lanterns at a point where the road "forks."

Specially interesting is the "Mirrorlite" lantern, which is equipped with a conically shaped band of diffusing glass attached to the lower edge of the reflector. This serves not only to screen the light source, but to prevent hard shadows being formed on the walls of adjacent buildings.

An attractive window display.

LINOLITE LAMPS—REDUCED PRICES.

A leaflet issued by Messrs. A. W. Beuttell Ltd. draws attention to the reduction recently effected in the price of Linolite lamps. Equipment for concealed lighting, of which this firm makes a speciality, is illustrated in considerable variety. Apart from the different types of strip reflectors there is the "Little Giant," designed for shop-window lighting with standard lamps, and the ingenious "K-Ray" system of display lighting which was recently shown before the Illuminating Engineering Society, and will doubtless be familiar to many of our readers.

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